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ABSTRACT

Computer Assisted Remedial Education (CARE) I was developed for preschool and elementary school teachers to provide a college level computer-assisted instruction (CAI) course dealing with the identification and diagnosis of handicapping conditions in children. This first volume of the final report of CARE I covers the purposes and objectives of the course, the nature of CAI, a general course description, phases of development, course materials, and evaluative methods and results. EM 011 037 through EM 011 043, EM 011 046, EM 011 047, and EM 011 049 through EM 011 058 are related documents. (Author/SH)

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COMPUTER ASSISTED INSTRUCTION LABORATORY

COLLEGE OF EDUCATION · CHAMBERS BUILDING
THE PENNSYLVANIA STATE UNIVERSITY · UNIVERSITY PARK, PA.

Computer Assisted Remedial Education:

Early Identification of Handicapped Children

Final Report

G. Phillip Cartwright
Harold E. Mitzel

Report No. R–44
June 1971

EM 011 053

Note to accompany the Penn State Documents.

In order to have the entire collection of reports generated by the Computer Assisted Instruction Lab. at Penn State University included in the ERIC archives, the ERIC Clearinghouse on Educational Media and Technology was asked by Penn State to input the material. We are therefore including some documents which may be several years old. Also, so that our bibliographic information will conform with Penn State's, we have occasionally changed the title somewhat, or added information that may not be on the title page. Two of the documents in the CARE (Computer Assisted Remedial Education) collection were transferred to ERIC/EC to abstract. They are Report Number R-36 and Report Number R-50.

— Jocelyn Carroll / ERIC/EM

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The Pennsylvania State University

Computer Assisted Instruction Laboratory
University Park, Pennsylvania

Final Report

DEVELOPMENT OF A COMPUTER-ASSISTED INSTRUCTION COURSE IN THE IDENTIFICATION AND DIAGNOSIS OF HANDICAPPING CONDITIONS IN CHILDREN

Project No. 482129
Grant No. OEG-0-9-482129-4394 (607)

Principal Investigators

G. Phillip Cartwright Harold E. Mitzel

July 1971

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Ultimate responsibility for course content rests with the principal investigators, Professor G. Phillip Cartwright and Professor Harold E. Mitzel. Professor Carol A. Cartwright played a major role in the overall development of the conceptual model. She also wrote many of the instructional chapters. Other persons who authored or contributed to the authoring of instructional chapters were Asa Berlin, Karen Braddock, Judson McCune, Gerald Robine, David Sabatino, Mary Sabatino, Deborah Schreiber, Robert Sedlak, Richard Starr, and Mary Ann Villwock. Alma Fandal, Steven Hunka, Ralph Peabody, and Herbert Quay served as consultants.

There are numerous support people to whom the investigators are also indebted. The programers--Karen Braddock, Rosemary Hollick, Carolyn Kendall, David Palmer, and Bonnie Shea--interpreted authored materials and programed it in Coursewriter II language. David Palmer supervised operations and coordinated activities with technical personnel. Other course related activities were handled by graduate assistants: Judson McCune, Robert Sedlak, Richard Starr, Mary Ann Villwock, and David Yens.

Leslye Bloom prepared all images for the image projectors and illustrations for the Handbook. Karl Borman was in charge of technical support. The narrative was recorded by Croy Pitzer.

Clerical support was provided by Kris Sefchick, Barbara Lippincott, Kathy Hatton, Sara Jane Thomas, Judy Harley, and Darlene Smith.

This report was prepared by David D. Palmer.

FOREWORD

Nearly four million handicapped children in the United States--200,000 in Pennsylvania alone--are not receiving the special educational services that they require in order to become self-supporting, self-respecting citizens. In order to adequately provide for these children, almost 300,000 more specially trained persons are needed to work with handicapped children. The present methods of training educational personnel cannot provide enough trained people to meet these needs.

CARE 1 was developed to provide a complete college-level computer-assisted instruction (CAI) course dealing with the identification and diagnosis of handicapping conditions in children. The course was aimed toward preschool and primary level teachers of seemingly typical children.

This course has been designed to demonstrate the contribution that new educational technology can make in the education and training of teachers (especially inservice teachers) and in providing high quality education to teachers who might not have the opportunity to return to a college campus for refresher training. It is hoped that the course will dramatize the effect that educational technology can have in the field of special education.

Personnel in the department of Special Education and Elementary Education and the Computer Assisted Instruction Laboratory at The Pennsylvania State University have cooperated to develop the program for the IBM 1500 Instructional System located at Penn State. When completed, the course was then transferred to an IBM 1500 System in a mobile laboratory and disseminated to teachers throughout the Pennsylvania Appalachian Region.

This Final Report of CARE 1 is in five volumes. Volume 1 covers the purpose and objectives of the course, the nature of CAI, a general course description, phases of development, course materials, and evaluative methods and results. Volume II is the CARE 1 Handbook, which is not only a summary of the course but also a valuable tool for the student while he takes the course. A Syllabus describing the content and objectives of each instructional frame is Volume III. Volume IV is a planning manual, a detailed description of all the programing techniques used in CARE 1. It is not only a report but is also designed as a programer's guide for future CAI courses. Volume V is a computer tape which contains the entire CAI course in an easily readable form. The tape also contains all the Coursewriter II coding.

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CHAPTER I

PROBLEM, ACTIVITIES, AND IMPLICATIONS

Introduction and Overview

This project attempted to improve the quality of experienced teacher preparation in the area of special education. A computer-assisted instruction course was developed which would provide intensive training in special education concepts to regular classroom teachers of elementary grades in rural schools in Pennsylvania's sparsely populated counties. A high proportion of the children in these counties come from low-income families who must depend heavily upon their local schools for long-term support and escape from poverty. The situation in Pennsylvania's Appalachian region reflects a pressing national need for special educational services. The CARE project was an attempt to help provide for this need.

Justification and Purpose

The Annual Report of the Bureau of Education for the Handicapped for the Fiscal Year 1969 states that over 62% (3.75 million) of the nation's handicapped children received no appropriate special educational services in school year 1968-1969 and that an additional 266,000 trained persons were needed but not available to provide special services to these children who did not receive care.

This appalling situation of unmet needs for educational services for handicapped children has not changed materially since the release of those statistics. It is obvious that an alternative or at least an augmented approach to the provision of special services to atypical children must be undertaken. The CARE project provides one alternative: preparing inservice teachers of regular grades to identify and adequately diagnose conditions in children which may adversely affect their school performances.

Specialists in early childhood education and special education continually stress the need for early diagnosis of educational or behavioral deviancy, followed by early intervention with programs designed to promote cognitive and social development, in order to help handicapped and disadvantaged children get off to a good start in life. It is the contention of these specialists, as well as the designers of this program, that the early years of a child's life are extremely important in terms of personality development and intellectual development. Unfortunately, most preschool and primary level teachers have not been trained specifically to identify children who are handicapped or who exhibit behavior which may be symptomatic of future educational difficulties.

In order to make appropriate educational judgments, i.e., judgments which result in educational planning aimed at intervention for the purpose of preventing potential learning problems, correcting existing learning problems, or enhancing learning assets, teachers need information about the atypical conditions and characteristics which are likely to be present to some degree in groups of school-age children. Information concerning both normal behavior and possible abnormal behavior in the cognitive, affective, and psychomotor response domains is the prerequisite for the task of screening children with reference to gross deviations. It is assumed that inservice teachers possess adequate knowledge concerning normal behavior and function in general, with expectations of normal behavior for the children in their classrooms. The developers of CARE 1 maintain that the majority of inservice teachers have not had the opportunity to acquire adequate information about the possible deviations, or abnormalities, in behavior that influence learning. Teachers need adequate information in order to make appropriate educational decisions.

Target Group

While the course is appropriate for teachers of all grade levels, it is especially directed to preschool and elementary school teachers. It is designed to give these teachers the knowledge and skills necessary to identify children who otherwise might be educationally retarded by the age of nine or ten. The course is also useful to other educational personnel such as principals and other administrators and supervisors, special class supervisors, school nurses, special services personnel, and other school related personnel, including day care workers. The course attempts to promote clinical sensitivity on the part of regular classroom teachers and develop in them a diagnostic awareness and understanding of the strengths and weaknesses of handicapped and normal children.

Approach

The question of how best to provide high quality inservice education programs to large numbers of teachers is a perennial issue. When viewed with reference to the very large number of handicapped children who would eventually be affected by these programs, the issue becomes crucial. The designers of this program maintain that, in contrast to the traditional approaches to inservice teacher education, a more individualized approach is more effective and efficient. Support for this method of approach can be found in several research studies. For example, Rudd (1957) found that inservice courses were of higher calibre when an individual teacher's background was taken into consideration and the inservice course was presented at the local level in close proximity to the elementary classroom. Houston, Boyd, and Devault (1962) worked with 252 elementary teachers in a multi-media approach which used closed circuit television, lecture, question-discussion, and written materials. They found that the teachers preferred the written materials and the question-discussion approach to teaching. Between March 1, 1969, and August 29, 1969, a CAI course in mathematics developed at the Penn State Computer Assisted Instruction Laboratory was given to a total of 387 elementary school teachers in Dryden, Virginia; Gladeville, Virginia; and California, Pennsylvania. It was concluded that it is feasible and desirable to incorporate CAI programs into inservice teacher education. The researchers for this program in remedial education, therefore, decided that administrators should consider procedures for individualizing inservice education programs for teachers.

The method of individualizing instruction used in this program was computer-assisted instruction (CAI). CAI provides an environment in which the material presented to the learner is selected and sequenced, with the aid of a computer, to be responsive to the individual learner's needs. The computer program selects sequences of instruction which are appropriate to an individual's background knowledge of the course content, his rate of progress through the material, and the types of errors (or non-errors) the student makes as he interacts with the system. Of all the methods of individualized instruction, including team teaching, programed texts, and low student/teacher ratios, CAI appears to offer the greatest promise for the major objective of individualized instruction--improved learning by the student.

Mobile Laboratory

The impact of the CARE course with regard to the individualization of instruction has been maximized by the Penn State mobile CAI laboratory, a new and innovative concept in inservice teacher education. The Mobile Laboratory is a custom built trailer with expandable sides and a specially designed "air ride." It is fully heated and air conditioned and is equipped with a complete IBM 1500 System and fifteen student instructional stations. Specifications for the van appear in Appendix A.

The van's mobility allows for dissemination of the course to large numbers of teachers residing in remote parts of the state. Hauled by a tractor, the Laboratory is located for six- to eight-week periods at centrally situated school buildings in selected Appalachian regions (see Appendix B). During these periods (and at times convenient for them), teachers, supervisors, and other interested educational personnel come to the Mobile Laboratory to take the CARE course. A maximum of 150 persons can be accommodated at each site.

Summary

The overall objective of this program was the development of educational procedures appropriate for a computer-assisted instruction course for inservice teachers. The purpose of the course was to train teachers in diagnostic and clinical assessment skills necessary for the identification and diagnosis of handicapping conditions in children.

CHAPTER II

COURSE DESCRIPTION

Purpose

The purpose of the course called Computer Assisted Remedial Education (CARE 1) is to give educational personnel the knowledge and skills necessary to deal effectively with children who have educational problems.

The course is appropriate for teachers of all grade levels but especially for preschool and elementary school teachers. The course is designed also to be of interest to other educational personnel such as principals and other administrators and supervisors; special class supervisors; school nurses; psychologists; aids; music, art, shop, and physical education specialists; special services personnel; and other school related personnel including day care workers.

The CARE 1 course is designed to prepare inservice preschool and primary level elementary teachers and other interested persons to know the characteristics of, and be able to identify, handicapped children. Handicapped children are defined, for purposes of this course, to be those children who have atypical conditions or characteristics which have relevance for educational programing. Handicapped children include children who display deviations from normal behavior in any of the following domains: a) cognitive, b) affective, and c) psychomotor.

The philosophy of the course is such that teachers are encouraged to look at children as individuals. The use of traditional categories or labels is minimal. However, certain terms and concepts related to handicapping conditions are taught so that persons who take this course are better able to communicate with other professionals in the field.

Objectives

Upon completion of the CAI course, participants will have achieved the following objectives that are directly correlated with the decision process flowchart shown in Figure 1. Participants will:

A. know the characteristics of handicapped children and be aware of symptoms which are indicative of potential learning problems;

B. be able to screen all children in regular classroom programs for deviations and determine the extent of inter-individual differences;

C. be able to select and use appropriate commerical and teacher-constructed appraisal and diagnostic procedures for those children with deviations in order to obtain more precise information related to the nature of the deviation;

D. be able to synthesize information by preparing individual profiles of each child's strengths and weaknesses of educationally relevant variables;

E. be able to evaluate the adequacy of the available information in order to make appropriate decisions about referral to specialists;

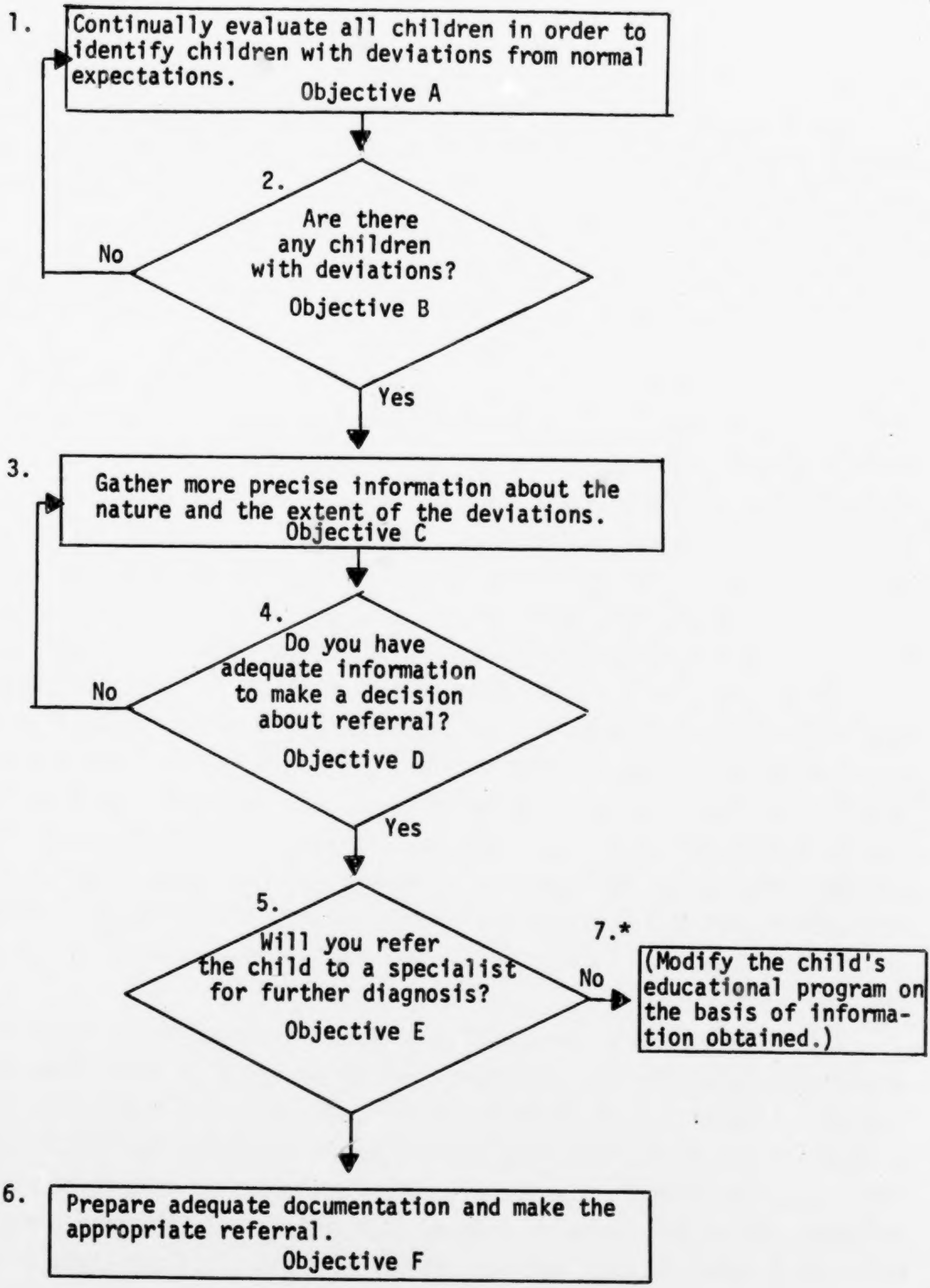
F. be able to prepare adequate documentation for a child if the decision to refer is affirmative.

It is expected that the teachers who exhibit the competencies listed above will systematically evaluate children's learning potential and formulate appropriate educational plans according to the decision process outlined in the following section.

Relationship Between Objectives and the Decision Process

The six objectives are directly associated with the first six steps (boxes) in the decision process (Fig. 1). The first two steps in the decision process dictate that the teacher evaluate all the children in the classroom in order to identify those children who exhibit deviations from normal behavior. Objectives A and B are related to the First and Second Steps in the decision process.

Evaluation should be thought of as a continuous process which is an integral part of the total educational effort. The evaluation process includes


1.
Continually evaluate all children in order to identify children with deviations from normal expectations.
Objective A
2.
Are there any children with deviations?
Objective B
No
Yes
3.
Gather more precise information about the nature and the extent of the deviations.
Objective C
4.
Do you have adequate information to make a decision about referral?
Objective D
No
Yes
5.
Will you refer the child to a specialist for further diagnosis?
Objective E
No
7.*
(Modify the child's educational program on the basis of information obtained.)
6.
Prepare adequate documentation and make the appropriate referral.
Objective F

---

*This step is the subject of a CAI course to be developed.

Fig. 1. Decision Process.

two major tasks: a) obtaining both quantitative (numerical) and qualitative (categorical) data about children's abilities in the cognitive, affective, and psychomotor response domains; and b) making value judgments about these data. To identify children who exhibit deviations from normal expectations is to make a value judgment that a particular behavior is considerably different from that which is displayed by a majority of the child's chronological age peers and is, therefore, different from the behavior usually expected of children in that age group.

In order to make appropriate educational judgments (i.e. judgments which result in educational planning aimed at intervening for the purpose of preventing potential learning problems, correcting existing learning problems, of enhancing learning assets), teachers need information about the atypical conditions and characteristics which are likely to be present, to some degree, in groups of school age children. Information concerning both normal behavior and possible abnormal behavior in each of the response domains (cognitive, affective, and psychomotor) is prerequisite for the task of screening children with deviations. It is assumed that inservice teachers possess adequate knowledge concerning normal behavior and operate, in general, with expectations of normal behavior for the children in their classrooms. The investigators maintain that the majority of inservice teachers have not had an opportunity to acquire extensive information about possible deviations, or abnormalities, in behavior which influence learning. Therefore, course content used in association with Objective A provides the basic information which is the prerequisite for the screening task (Steps One and Two) and for subsequent tasks in the decision process.

The following items are examples of the course content for Objective A: a) definitions of atypical children; b) descriptions of various groups of atypical children such as mentally retarded and emotionally disturbed children; c) descriptions of children with speech, motor, auditory, and visual problems; and d) justification for the use of certain variables in describing atypical children. Since the course is intended for teachers working with preschool and primary level children who may not yet manifest clear-cut signs of atypical behavior, teachers are given information related to the more subtle clues to incipient problems.

Acquisition of the prerequisite information allows the teacher to identify, or screen out, those children who exhibit deviations from normal behavior. Achievement of Objective B enables the teacher to make correct use of data which are usually readily available to classroom teachers. Course content directed toward Objective B focuses on the following: a) the relative nature of normality in terms of socio-cultural factors, and societal and educational expectations; b) inter- and intra-individual differences; c) interpretation of information which is generally available for all children in the group such as results of group intelligence, readiness, and achievement tests, questionnaire responses concerning home and family; and d) the continuous and circular nature of the screening process.

During the first phase of the decision process, the teacher surveys the entire group of children for performance on certain relevant variables in order to select those individuals who exhibit deviations of a sufficient degree to warrant more intensive diagnosis. With the completion of the screening at any one time, the teacher will have formulated "suspicions" or hypotheses about some of the children in the group and will proceed to the third step in the decision process for these children. It should be noted that the teacher would continue to use the screening process as new group data become available.

During the third step in the decision process, the teacher gathers precise information concerning the nature and the extent of each individual child's deviation. Objective C is associated with this step. At this point, the teacher adds information about each child's intra-individual differences to that previously obtained (in the first step) about the inter-individual differences. The teacher needs to obtain data concerning discrepancies within the individual's growth pattern (the child's specific abilities and disabilities) and for each of the children selected during the screening process.

Achievement of Objective C enables the teacher to perform at the third stage of decision making. Course content for Objective C includes: a) rationale for use of a variety of appraisal procedures; b) use of commerically prepared tests and non-testing materials; c) techniques of constructing and using teacher-made tests and non-testing procedures, both formal and informal;

d) criteria for selection of appraisal procedures with emphasis on validity and reliability relative to a variety of purposes; e) sources of information about the child from other individuals, such as peers and parents; f) use of day-to-day informal situations, devised by the teacher, to yield information about attainment of specific behaviors of interest. The emphasis at Step Three of the decision process, and for Objective C, is on individualizing appraisal for each child with reference to the deviations noted during screening. The teacher seeks information _in addition to_ that which is usually available for all children, and this information will be unique to the deviation for which the child was screened out of the total group.

Tentative completion of the third stage in the decision process, together with achievement of Objectives D and E, enables the teacher to evaluate the comprehensiveness of the obtained data and, therefore, make the decisions required in Steps Four and Five. Course content associated with Objective D includes: a) description of profile charts and related diagrams; b) procedures for selecting certain variables for inclusion in an individual's profile; c) interpretation of normative data; d) rationale for the use of various kinds of information, from a variety of sources, in combination; and e) techniques of constructing and using profile charts and related diagrams. Course content for Objective E consists of: a) criteria for determining the comprehensiveness of the obtained data; b) information concerning the specialists who can be expected to provide various types of intensive diagnostic services for children; and c) descriptions of the classroom teacher's role in relation to the roles of various specialists.

If the teacher makes a negative decision at Step Four, he needs to return to Step Three and collect the information required to complete the child's profile chart before proceeding through to Step Five. However, if the teacher is able to make an affirmative decision at Step Four, he will proceed immediately to the next decision block, which is Step Five in the process.

In formulating an answer to the question posed at Step Five, the teacher asks himself: Have I exhausted all sources of information available to me in my role as a classroom teacher? Can I make educational plans for this child on the basis of information currently available? Do I need more information before making educational plans for this child?

If the decision at Step Five is for referral, the teacher will proceed to Step Six. Objective E is related to Step Six. Course content associated with Step Six includes: a) criteria for selecting the appropriate specialist for various types of referrals; b) procedures to be used in documenting the request for referral; c) descriptions of general procedures to be followed in making referrals; d) activities which might be required of the teacher subsequent to requesting a referral; and e) feedback to be expected by the teacher relative to disposition of the referral.

If the decision for referral at Step Five is negative, the teacher will be responsible for modification of the child's educational program within the regular classroom setting (Step Seven in the decision process). It is not possible in this one course to deal with extensive modification of pedagogical programs. A second course is planned to cover this problem. Modification of programs for atypical children would include the following topics: a) techniques of effective classroom management; b) specialized teaching strategies which might be used for amelioration of difficulties, or for enrichment, in various subject-matter areas; c) special materials to be used in association with specific strategies, d) sources of information regarding specialized strategies and materials; and e) resource persons usually available to assist classroom teachers.

Structure

The CARE 1 course is divided into twenty-two chapters, each chapter being a relatively discrete portion of instructional information. The general structure is shown on the following page in Figure 2.

The course is introduced by the segment called How To, which is designed to familiarize the student with the various parts of the computer terminal (the CRT, the image projector, the audio unit, and the earphones) and with the methods of responding (the keyboard and the light pen). The student is also asked in this on-line segment to provide the biographical information needed to satisfy the requirements of the federal sponsoring agency.

Chapters 1 through 5 present background information and serve as an introduction to the rest of the course. Chapter 1 presents the structure of the

Outline of CARE 1

Chapter	Title	Segment	Labels
	How To; BIB (Biographical Inventory)	0	aa01/bib01a
1	Overview	3	aa01a
2	Information Processing Model	30	da01a
3	Interrelationship of Handicaps	33	dd01a
4	Gathering Information About Children	10	a001a
5	Decision Process	20	ca01a
6	Mental Retardation	40	c201a
		42	ec01a
7	Cultural Disadvantage	46	eg01a
8	Emotional Disturbance	52	en01a
		53	em01a
9	Visual Problems	60--64	fa01a
10	Hearing Problems	65	ga01a
11	Speech Problems	70	ha01a
		71	hb01a
12	Motor and Health Problems	80	ja01a/jb01a
		81	jc01a
13	Learning Disability	92	jn01a
14	Individual Differences and Normality	6	ab01a
		4--5	ae01a/af01a
15	Profiles of Individual Differences	7	ah01a
16	Reliability, Validity, and Usability	11	a1x1
		12	bc01a
17	Screening Instruments, Part One	41	eb01a
18	Screening Instruments, Part Two	23	cd01a
19	Screening Instruments, Part Three	24	ce01a
20	Documentation and Referral Procedures	96	jp01a
21	Case History	100	ka01a
		101	ka73a
		102	kb60a
22	Summary	105	ma01a
	Final Examination	120	m001a/a1--n17
		127	Sign-off

Fig. 2. General structure of CARE 1 course.

course and states the overall objectives. Chapters 2, 3, and 4 present basic concepts integral to the course content, and Chapter 5 introduces the Decision Process Flowchart that is used as an organizational guideline throughout the course.

Chapters 6 through 13, as their titles imply, each present information about the symptoms and typical behaviors of children with a particular disability. Attention is also given to the appropriate specialists to whom the disabled child should be referred and methods of dealing with the child in the regular classroom.

Chapters 14, 15, and 16 deal with the quantitative measurement of educational variables. Chapter 16 also serves as an introduction to the use of screening instruments.

Chapters 17, 18, and 19 each present a thorough examination of an instrument used to identify children who are likely to have difficulty in regular educational programs. Emphasis is placed on the appropriate uses of each instrument and on proper administration and scoring procedures.

Chapter 20 is concerned with the adequate documentation of the symptoms and behaviors of children who are to be referred to a specialist. The chapter also introduces the techniques of behavior modification as a means of dealing with problem children while they remain in the regular classroom.

Chapter 21 consists of three case studies. Following the guideline of the Decision Process Flowcharts, the learner is required to gather information and make appropriate educational decisions for each of these children as in a regular classroom situation.

Chapter 22 is a brief summary, reiterating the principal concepts that are stressed throughout the course.

After the students have completed the course they are presented the final examination consisting of 75 multiple-choice and completion items selected by a method of stratified random sampling from a pool of 225 items. The on-line stratified random sampling feature enables each student to have an individually selected examination, and it is rare for any two students to be presented with the same item simultaneously.

Upon completion of the CARE 1 course, each teacher earns three Penn State graduate credits.

Supplemental Materials

Textbook. The textbook used in conjunction with the on-line material of CARE 1 was Teacher Diagnosis of Educational Difficulties edited by Robert M. Smith (Charles E. Merrill, Columbus, Ohio, 1969). The book contains contributions from nine specialists in all areas of early academic and personal development. These specialists describe methods for diagnosing the strengths and weaknesses of individual students and suggest remedial procedures for helping students overcome deficiencies. The book is designed to help teachers at all levels become more effective and efficient in the classroom by appropriately using informal diagnosis in day-to-day evaluations of student progress. It is the intent of the book's editor and contributors that the development of these evaluation procedures will allow teachers the opportunity to individualize their instructional strategies to accommodate each student's educational needs.

Handbook. The 400-page Handbook was written especially for CARE 1. It is used by students throughout the course and contains, among other things, a 350-item glossary of critical terms. It has essentially two functions; it is a guide for the student while he takes the course, and it is a reference tool and a comprehensive outline for reviewing course content after the course has been completed. Besides the summaries, there are reference materials such as charts, tables, student cumulative records, examples of evaluation devices, definitions, and samples of key graphic material from the course. At the end of each chapter in the Handbook there is also an up-to-date list of content-related references.

While the student takes the course, he can also use the Handbook to jot down notes and observations. In fact, students are urged to keep the Handbook with them at all times during on-line work. They are also asked to read ahead and prepare themselves for their next on-line session. For example, before beginning Chapters 1 and 2 on-line, students are asked to read Chapters 1 and 2 in the Handbook. To facilitate this activity, the Handbook is divided into chapters which parallel exactly the chapters of the course.

At the end of each on-line chapter, Handbook reading assignments appear. Most of these readings serve as reminders to suggest that the student try to keep two chapters ahead of the course.

A complete Handbook is included in this Final Report as Volume II.

Screening instruments. Chapters 17, 18, and 19 of CARE 1 instruct the student in the use of three screening tests (or instruments): the Denver Developmental Screening Test (DDST) (Frankenburg, Dodds, and Fandal, 1970), the First Grade Screening Test (FGST) (Pate and Webb, 1969), and the Metropolitan Readiness Test (Hildreth, Griffiths, and McGauvran, 1965). Each student receives his own copy of the tests and simulates the scoring and interpretation of results. Validity and reliability information, standardization procedures, and instructions for administration and scoring are discussed in detail.

Screening tests essentially "screen out" or "sort out" those children who deviate significantly from the behavior of a normal group of children. Screened out children are those who will probably have difficulty progressing at the normal rate in a regular school program.

Screening test results, however, do not reveal the nature of a child's problem. Nor do they provide a definitive diagnosis or indicate a treatment. The diagnostic capabilities of screening tests are very general in nature.

There are, of course, other sources of information that can yield screening information. Some are designed to identify more specific problems in children. The Snellen E Chart screens vision problems. X-ray examinations will identify tuberculosis in children. It is also possible to use the results of tests on general mental ability in screening procedures. Screening instruments related to such specific problems are discussed in pertinent chapters of the Handbook.

Data gathered from these and other sources are combined with the regular screening tests to provide more accurate results than would be possible with the screening test data alone.

Denver Developmental Screening Test (DDST)

The DDST was designed to identify development problems in children. It is administered individually and is appropriate for children aged about one month to six years.

The DDST form (see Appendix C) contains 105 developmental tasks. Each child is administered only those tasks that are appropriate to his chronological age. The test was designed for people with no special training in psychological testing and is relatively easy to administer and score.

The 105 tasks are grouped into four sectors:

1. personal-social, the ability to get along with others and to care for one's self;
2. fine motor-adaptive, the ability to see and to use hands for various purposes;
3. language, abilities related to hearing and speaking, and;
4. gross motor, abilities such as sitting, walking, and jumping.

On the scoring sheet, the tasks are grouped according to sector and are positioned in relation to a graduated age scale printed across the top and bottom of the form. Markings indicate the age at which certain percentages of the children in the normative sample could perform each item.

The test kit includes eight items such as a rattle, colored boxes, and a small bell which are used for eliciting the children's responses.

First Grade Screening Test (FGST)

The First Grade Screening Test was designed to screen out children who would probably have difficulty learning at the first grade level. There are children who would not, without special help, make sufficient progress in the first grade to be ready for the second grade. The FGST serves to prevent them from suffering the experience of failure.

The FGST is administered to children at the end of their kindergarten program or at the beginning of their first grade year. Early administration of the test provides more time for educational planning.

The FGST is a group test. A group of 15 to 20 children seems to be the optimum number for efficient administration. Each child has his own test booklet, with one test item printed on each page to prevent confusion. There is no time limit set on the test, though from 30 to 45 minutes seems to be sufficient for most children to finish.

There are three major handicaps with which the FGST deals: intellectual retardation, central nervous system dysfunctions, and emotional disturbance. These handicaps are often manifested together or in combination with one another. The FGST yields a single, composite score. When a child receives a low score on the test, more specialized evaluation is often needed to determine the child's specific strengths and weaknesses.

Metropolitan Readiness Tests

The Metropolitan Readiness Tests exemplify the use of a group test of general aptitude for the purpose of screening. Tests such as the Metropolitan Readiness Tests are often routinely administered to children early in their school experiences.

The test is intended to measure the extent to which young children have acquired skills and abilities which contribute to readiness for the tasks typically required in first grade. Those children who perform well on the test have a good chance of achieving first grade work without difficulty. Those children who do not perform well will probably experience some difficulty in learning during the first grade.

The test is designed to assess the most important components of first grade readiness:

1. comprehension and use of oral language;
2. visual perception and discrimination;
3. auditory discrimination;
4. richness of verbal concepts;
5. general mental ability; capacity to infer and to reason;
6. knowledge of numerical and quantitative relationships;
7. sensory-motor abilities of the kind required in handwriting, writing of numerals, and drawing;
8. adequate attentiveness; the ability to sit quietly, to listen to and follow directions.

The Metropolitan Readiness Tests should be administered at the end of the kindergarten program or at the beginning of the first grade year. The test is comprised of six required subtests and one optional subtest:

1. word meanings;
2. listening;
3. matching;
4. alphabet;
5. numbers
6. copying;
7. draw-a-man (optional)

The test manual outlines the following uses of the Metropolitan Readiness Tests for the classroom teachers:

> 1. obtain quick indication of readiness of each of his pupils to do first grade work, especially with reference to reading and arithmetic;
>
> 2. identify specific areas in which a child (or group) appears not to have attained the level of maturity of skill adequate for coping with first grade work;
>
> 3. as an objective, reliable basis for the initial grouping of pupils for instructional purposes;
>
> 4. assess the range of readiness among his pupils so as to better define instructional problems;
>
> 5. adapt instruction to the level of the class and of subgroups he may organize;
>
> 6. indicate when formal work in numbers and in reading should be started;
>
> 7. determine whether pupils have progressed in accordance with their readiness or aptitude by comparing readiness test results with achievement test results or teacher grades at the end of the year.

CHAPTER III

COMPUTER-ASSISTED INSTRUCTION

Potential

It was felt that the most efficient and effective means for providing teachers with this much needed instruction was through computer-assisted instruction (CAI).

Because each student can learn from and interact independently with a CAI course, and because the computer program can execute logical decisions based on the analysis of incoming real-time student performance data, there exists the capability for intelligent adaption of instruction for each student. The logical decision making ability of the computer program, along with its extremely rapid access to large volumes of stored information, combined with the knowledge and skill of the author-programer, can provide for a wide variety of individual differences among learners. Mitzel (1967) states:

> Indeed, in sophisticated tutorial programs which involve many remedial branches and frequent examination of the learner's mastery, it is likely that no two learners in a group will ever take the same path through the material. In the tutorial mode, maximum adaptation can be made to individual differences exhibited by the learners. (Mitzel, 1967, p. 5)

Dick (1965, p. 51) identified the following potential advantages of computer-assisted instruction:

> 1. The computer can carefully control the learning sequence of the student; in fact, it forces the student to comprehend each frame. It also prevents cheating.
>
> 2. The computer can judge constructed responses for accuracy. When several answers are acceptable, the student is not left wondering whether his response is correct or incorrect.
>
> 3. The computer may offer a more stimulating learning situation than the dull one sometimes provided by programed texts.
>
> 4. The computer can utilize background information on each student, including both personality traits and abilities, for constructing learning sequences and judging responses.

5. The computer is more versatile than the programed text. It can teach a wider variety of tasks and employ a wider range of auxiliary stimulus-presentation equipment.

6. The computer offers data on the entire learning session as well as summary data. These data are useful both for school records and research purposes.

7. The computer can be used for a multitude of jobs besides instructing. Grades, attendance records, inventories, scheduling, etc. can be processed by the computer.

8. The computer may, as a long-term investment, be less expensive and less space-consuming than programed texts.

In addition to the foregoing advantages, there are several additional factors which should be considered.

1. Intensive use of CAI can generate a unique motivational environment.

2. Student populations of widely varying backgrounds can be helped to achieve recognized standards.

3. Students of lower aptitude can be stimulated by controlling the success ratio and maximizing the learning reinforcement. This is of particular importance for educationally and culturally handicapped students.

4. Inservice education and refresher courses for teachers can be made available with the same CAI system.

5. Updating information in the CAI program or changing teaching strategies can be accomplished with relative ease.

6. A uniform standard of quality is maintained in every location in which the course is offered.

When the CARE course was conceived, it was sufficiently clear that the potential advantages of CAI warranted much more than the current level of experimentation. Based on initial experimentation, it was found that the balance of risk and opportunity was highly favorable. In a learning environment, for instance, there are some functions analogous to those in other activities to which computers have been successfully applied. The management of instructional presentation and the monitoring of student performance are functions well adapted to the use of computers. It was also clear that CAI would provide a way to manage and present individualized instruction and, as such, be a powerful instructional tool. Indeed, there is little question that it will play an increasingly important role in education in the future.

CAI Teaching Modes

The CARE 1 course uses a wide variety of instructional strategies to assist learners in reaching the course objectives. All the strategies are interactive and all require active participation by the learner.

The most prevalent strategy used in the course is the tutorial mode. This mode simulates the master tutor engaging in an interactive dialogue with an individual learner. The tutor presents information, asks penetrating questions, and carefully analyzes the learner's responses to the questions. On the basis of the learner's demonstrated understanding or lack of understanding of a given concept, the tutor provides alternative courses of instruction, remedial sequences of instruction or even enrichment material. The tutor can move a capable or well-informed learner through a course of instruction very rapidly. Similarly, the tutor can tailor a sequence of instruction to meet the needs of a learner who is not as capable or does not have a good background of experience or preparation.

Since the sophisticated CAI system can perform the chores of dozens of tutors rapidly and efficiently, the net effect is that hundreds of learners in the CARE course are individually tutored in certain special education skills.

The second major mode of instruction used in the CARE course is the inquiry approach. This type of activity is used in the latter stages of the course to draw together all the concepts acquired by learners throughout the course. This strategy included simulation of regular classroom problems as well. In essence, the inquiry and simulation modes as used in the CARE course are directed problem solving strategies. Learners are told that they have access to information about a class of first-grade children. Three of the children in the class are handicapped or have an educational problem of some kind. It is the learner's task, in effect, to screen the class for children with educational problems, identify those children with potential or existing problems, and deal with each problem by modifying the child's educational program or making an appropriate referral. The learner begins the screening by looking over the cumulative records of the children in the class. After the three children most deserving of special attention are identified, the learner is able to ask the computer for additional information about each child. The learner is, in fact, given access to information irrelevant to the children's problems. If a false assumption is made because of faulty reasoning or because it is based on irrelevant or insufficient information, the program allowes the learner to follow an incorrect strategy until the error becomes apparent to the learner.

Eventually, as a result of skillful questioning on the part of the CAI program coupled with the appropriate line of questioning by the learner, an appropriate diagnosis is made, and a decision is reached by the learner to refer the child to a specialist or to modify the child's pedagogical program. The learner's decisions and remediational strategies are evaluated by the CAI system.

Facilities

The Computer Assisted Instruction Laboratory at Penn State has been in existence since 1964. Since that time the Laboratory has grown from a staff of four part-time faculty members to a present total of 53 University employees (faculty, graduate assistants, technicians, and clerical staff), equivalent to 38 full-time persons.

Quantity and sophistication of equipment has also changed. The Laboratory, which started with a single teleprocessing typewriter terminal, now has a self-contained CAI system. In December 1967, the CAI Laboratory acquired and installed the first computerized system designed for instruction--the IBM 1500 Instructional System. This system is located in Chambers Building on the Penn State campus at University Park, Pennsylvania. The system presently consists of 12 instructional stations, each with a cathode ray tube display, a light pen, and a typewriter keyboard. Eight stations have audio record and playback devices and an image projector as well.

The most important device at the instructional station is the cathody ray tube (CRT). It is the main interface between the student and the computer and is similar in appearance to a small television screen. Lines of text and specially designed line drawings appear on the CRT. The screen has an area equivalent to 640 display positions, that is, sixteen horizontal rows and forty vertical columns. Information sufficient to fill the screen is available in microseconds from an internal random access disk. A light pen device is attached to the CRT and enables the learner to respond to displayed letters, figures, and graphics by touching an appropriate place on the screen. The coordinates of the lighted area touched are matched with the programed coordinates, and appropriate feedback is displayed. Also attached to the CRT is a typewriter-like keyboard. A student responds by typing an answer which appears simultaneously on the CRT at a location established beforehand by the course authors. This response is also matched against a programed response with the appropriate feedback given. Four dictionaries of 128 characters each can be used either in programing or for a student's response. This, for example, would make it possible to teach a mathematics course using four different sets of symbols simultaneously.

A second medium for presenting course material is the IBM 1512 image projector. When loaded with a 16mm microfilm reel, the 1512 is capable of showing 1,000 still photographic images in black and white or color. The images can be individually accessed at the rate of forty images per second under program control.

A third medium is the IBM 1506 audio play/record unit. By means of four-track magnetic tapes, pre-recorded information is presented. The audio messages are coordinated with the other instructional presentation. The audio unit also allows the student to record responses which can be analyzed after the student has completed the course.

Equipment to support the instructional station is, of course, essential. The 1131 Central Processing Unit (CPU) provides storage of data and is the nerve center directing activities of all other components. The 1442 Card Read Punch is used to input course content from punched cards and to punch out previously stored course content. A 1403 Printer lists course content for use by a programer or instructor. Two essential controlling devices are the 1133 Multiplexer and the 1502 Station Control Unit. The first coordinates disks, tapes, and the instructional devices; the second relays messages from the instructional stations to the Central Processing Unit. There are two 2310 Disk Storage Drives. Disks containing magnetically stored data operate in these disk drives. There are also two 2415 Tape Drives which store such data as student performance records. The 1518 typewriter is an input device much like the keyboard on the 1510. It can also type out course information on paper. The 029 Card Punch is used for punching codes on standard data processing cards.

The CPU, which can accommodate up to thirty-two student stations with these four instructional devices, contains 32,786 sixteen-bit "words" of core storage. The 2310 disk drives, which store usable course information and operating instructions, consist of 2,560,000 characters. The core storage cycle time for the tape drives which record the interaction between the program and the student for later analysis and course revision is 3.6 microseconds. The read/write time for disk storage is 27.8 microseconds per word.

Since the computer can record and recall student responses (the number of correct answers, the number of wrong answers, and so on), the sequence of instruction for a particular student can be altered on the basis of his responses. More challenging material or remedial instruction may be presented on the basis of past performance, or sections of the course may be skipped if the student's performance is at a specific level of proficiency. When a student signs on again to a course after having once signed off, he resumes his instruction at his earlier sign-off point.

The computer can be used to record a variety of information for all students, e.g., the exact contents of his response, the number of seconds he takes to respond, and his exact position in a course. Summary information such as number of correct responses to a question and total number of response attempts may be produced for analysis by the instructor, thereby reducing the teacher's clerical duties and freeing him to give individual instruction.

The computer will accept course content in two ways: 1) punched on cards, or 2) input directly from the instructional station keyboard. Using the second method, the contents of a course can be replaced, corrected, or deleted easily and quickly by special author commands.

Configuration of the system is shown in Appendix D.

Exterior and interior views of the Penn State Mobile Computer Assisted Instruction Laboratory are shown in Appendix E.

CHAPTER IV

COURSE DEVELOPMENT

All activities undertaken in this project were devoted to the development and evaluation of a computer-assisted instruction course dealing with the identification of handicapping conditions in children. A number of specific tasks were involved, but each of the tasks was related to the overall purpose of the project. The phases and the sequences of tasks are explained in the following sections.

Phase 1:
Refinement of Course Description

The first task undertaken by the investigators and research assistants was the refinement and expansion of the Course Description (page 5 of this report). The Course Description describes the content to be covered in the courses and defines the overall strategies to be employed in presenting the material. It provides the framework to which specific objectives were added during the next phase. When complete, the Course Description indicates the procedures that teachers employ in the diagnostic procedures to teach atypical children.

Phase 2:
Specifying Behavioral Objectives for Course Segments and Frames

A major step in course development was the identification of the specific behavioral objectives of the course. This step was carried out by the investigators with the aid of the research assistants. In CAI terminology, these people are known as authors because they write the course content and specify the educational strategies that are to be used.

The Course Description was used as the basis for developing specific objectives. Objectives and desired student behaviors and responses were determined for each interaction between student and CAI system. Each interaction frame required some response from the student; satisfactory responses were determined in advance. See Syllabus in Vol. III of this report.

Phase 3: Writing Course Material

After Phase One was completed and Phase Two was well underway, the authors began writing the course material. The course material was directly related to the objectives specified in Phase Two. The purpose of the course material was to help the learner achieve the level of performance required for satisfactory completion of terminal responses associated with each objective.

The investigators determined the sequence of the course material and the overall and specific instructional strategies associated with a given set of objectives. The graduate assistants, after instruction by the investigators, prepared preliminary items, graphs, visuals, anticipated responses, and other materials required for a given set of objectives. The investigators then reviewed the preliminary material for relevance to objectives and sequencing.

Course materials and instructional strategies were planned so as to take full advantage of the unique capabilities of the CAI system. These capabilities provide for instruction in different media but, more important, can also provide the means by which individualization of instruction can be achieved. Thus, the authors were able to provide for different amounts of prior knowledge of course concepts as well as different styles of learning and rates of progress.

Phase 4: Preparation of Course Material for the CAI System

When segments of course material were written by an author, the segments were given to educational programers[1] for translation into a format acceptable to the computer system. The course material was translated into Coursewriter II, a language designed specifically for computer-assisted instruction. During this phase and the preceding phase, the educational programers consulted extensively with the authors as programing problems arose.

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[1] N. B. Spelling of "programer" and "programing" will be used to indicate CAI applications; "programmer" and "programming" refer to computer applications, such as the use of Fortran, Cobol, etc.

The authoring of CAI course material is an exacting, somewhat laborious task. However, the Coursewriter II language can be learned fairly rapidly and is not as difficult as other computational or business oriented languages. Also, an extensive library of short, often used, instructional "programs" (called macros or functions) had already been developed by the Penn State CAI Laboratory. These pre-processed "programs" were used by the educational programers for many of the routine "page-turning," branching, comparison, and testing aspects of programing. Thus, many of the technical and programing problems often associated with computer-assisted instruction had already been solved.

It is essential that an efficient procedure for processing authored material be devised as soon as possible, for the writing and programing of text takes up most of the time in the first phase of course development. For instance, basic questions about translating the author's text into usable input must be answered early: How much Coursewriter language should authors be required to know? Must the author indicate restart points? What percentage of the course should be developed by the "deck-building" method?[2] What specific operating procedures should be established between the programer and keypunch operator?[3] When should "fp's" (image statements) and "aup's" (audio statements) be inserted? What system should be used for labeling? What system should be used for coding "ep identifiers?"

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[2] "Deck building" is a method for producing a stack of punched computer cards which are then assembled into the computer. On the IBM 1500 System, course material can also be input "on-line." But this method is slower, and it degrades the system for use by others.

[3] For instance, should coding and text be punched together? Should there be an "enter" after every line of text? Should all feedback be in capital letters to set it off from other text? How should underlines be handled?

The procedure finally adopted for CARE 1 included four basic steps. First, the author wrote out instructional blocks of material as well as directions to the programer on specially designed program sheets. The directions usually related to the placement of images and audio messages and the location of branching statements. Though authors were not required to know Coursewriter, they were asked to work within certain broad formating limits.[4]

In the second step, the programer edited the instructional text for the keypunch operator. That is, he cleared up illegibilities and obvious grammatical and typographical errors.[5] He also penciled in any unique Coursewriter statements not available in a supply of mass-punched computer cards used later in the "deck-building" process (explained in Step Four). It was found that the amount of editing and "penciling in" depended, to a large extent, on the competency of the keypunch operator and on the efficiency of the procedure followed by the operator and programer. When both competency and efficiency are high, certain unspecified assumptions can be made. When not, the programer will be required to detail all instructions, since error-free results at this early stage of development are essential.

In Step Three, the keypunch operator, using the edited program sheets, prepared a primary deck of punched cards. They consisted mainly of textual material and of unique Coursewriter statements. These two types of cards were punched separately and were combined by the programer during deck-building.

In the Fourth Step, the programer had two responsibilities: deck-building and initial, on-line debugging. In deck-building, the programer intercalated into the primary deck unique Coursewriter statements and the pre-punched statements most commonly used.[6] In CARE 1, each line of text was preceded by a single dt (display text) card. But because there was a considerable amount of text, execution time was slowed down and disk size was considerably expanded. If the alternative usually suggested is followed in the future, that is, if one dt card is used for several lines of text, it should be remembered that the keypunch operator will be required to insert a return-index after each line of text.

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[4] It is probably a good idea to have authors submit a few of their first programing sheets so that errors and problems can be detected before they write too much.

[5] Because illegibility can cost time and money, it would seem wise to show authors as early as possible how self-defeating it can be.

[6] Such cards might be dt's (display text), pa's (pause), fn's (functions), de's (display erase), etc.

After the completed CARE 1 deck was assembled into the computer, the programer's second responsibility was initial on-line debugging. In this step the objective was to insure that assembled material and course flow corresponded to the specifications laid down by the author on his programing sheets.

Phase 5:
Testing and Revising the Course

In the development of a CAI course, testing and revision occur continuously throughout the various phases of course development. Revision of objectives and course material may occur before the material is translated into the programing language. Some of the course material may need to be revised before the course can be translated into the programing language or before it can be entered into the system. Some "debugging" and revision usually is required to make the course run smoothly on the system. At this point, authors and programers should "take" the course to check it for errors in sequencing and content.

The second stage of revision began after segments of the course were operational. The CARE 1 course was tested by several pilot groups of students. Fifteen students took the course in the early summer of 1970, and fifteen students took the course in late summer of 1970. To maximize the benefit of this developmental procedure, a system for recording and revising errors was devised. Each student in the first pilot group was accompanied by a proctor who recorded, on 5 x 8-inch cards, the student's comments and the obvious program "bugs." (Bugs included errors in CRT displays, graphic displays, images, and audio messages.) The 5 x 8-inch cards were then arranged in the correct label sequence within segments after being divided according to "concept" revisions and "program" revisions. Program revisions went immediately to the programer.

Concept revisions were reviewed first by the author then passed on to the programer, often with additional notes. The author then passed on to the programer certain revisions gleaned from student records. Such things as type of errors, number of errors, number of requests for help, response latencies, and other information were analyzed by the author and programers to pinpoint problems in content, pedagogy and programing. When all such revisions were collected, the programer revised the course segment by segment.

The same procedure was followed for the second CARE 1 pilot group, except that the students recorded comments without the aid of a proctor.

In the fall of 1970, two advanced graduate students in Special Education took the course, following the same recording procedures. In addition, after completing the course, these students each compiled a detailed evaluation of all the segments of the course with special emphasis on the objectives and the effectiveness with which the objectives were met.

Documentation

DOCUMENT. CARE 1 is a thoroughly "documented" CAI course. This means there exists a complete printed version of not only its content and strategies but of other more specialized types of information.

Documentation has become increasingly necessary as CAI has developed into a viable instructional mode and as demands for information about completed courses increase. To a great extent, documentation also reduces the chance of duplicating existing courses.

The primary purpose of documentation, then, is to provide information. At least three different audiences are involved: 1) administrators, 2) instructors, and 3) programers. In general, administrators will be those responsible for purchasing and for curriculum planning. Some may understand computer languages and programing techniques; most, however, will be concerned with more general problems such as systems compatibilities and basic course content. Instructors, on the other hand, will be interested in specific course content, in teaching strategies, and in the uses made of different instructional media.

The programer's interests (either Coursewriter programers or system programmers) will be pointed toward the technicalities of the computer language and toward the system requirements.

Since good documentation should supply information for all these audiences, it must not only include technical details but also appear in an easy-to-read format and in understandable English. The three sections of the documentation system produced for CARE 1 supply such information.[7]

Section 1 consists of representations of screen (CRT) displays. Along with each screen display, there are descriptions of answer processing procedures as well as descriptions of activities at an instructional station: the positioning of images (and their numbers), the closing of the image shutter, the positioning and playing of audio messages (and their names), the descriptions of response limits, and the coded response identifiers. The answer mode, i.e., keyboard or light pen, is also indicated.

The screen display itself dominates each page of print out. It is framed on the left by a column of numbers corresponding to screen rows and at the top by the numbers of screen columns. Within this frame appears exactly what the student sees on the CRT. Though graphics also appear, the system can provide only "near" representation. In general, this section of DOCUMENT offers both the programers and non-programers a sequential and graphical representation of CARE 1.

Sections 2 and 3 of DOCUMENT are of use primarily to programers and/or systems personnel. Section 2 is the coding section containing a complete list of Coursewriter II statements similar to the listing used by programers during course development. The DOCUMENT listing, however, includes two additional features: card sequence numbers and segment statement numbers. Section 3 is a complete cross-reference table showing not only which audio messages, buffers, counters, functions, film images, labels, etc. have been used but also where

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[7] The program is called DOCUMENT. Though it was originally written for CARE 1, it has now been adapted to most courses developed at the Penn State CAI Laboratory.

they have been used with respect to course labels. The left column of a print out identifies the item being referenced: the actual label, a number of an image, the name of a macro, the op code of a function, etc. The next column is a one-character symbol identifying the item: L for label, I for image, A for audio, etc. To the right of this are the segment labels in which the listed item appears or from which it is accessed.

This cross reference section is an invaluable tool for the programer. With it he can immediately locate any of the above listed items (audio and image print outs) in any part of a course.

In May of 1971, the DOCUMENT program was revised so that it would print out all the audio messages (456) and summary descriptions of all the images (412) in CARE 1. These appear, segment by segment, at the end of the three documentation sections of CARE 1. Audio messages are first, in alphabetical order, followed by images in numerical order.

A more complete write-up of DOCUMENT is contained in Appendix F.

Planning Manual. Planning the day-to-day operation of a CAI course like CARE 1 is complicated not only because different educational and technical personnel must closely coordinate their activities, but also because many operations (e.g., image and audio production and deck building) differ widely in their completion times. In order to pass on to future CAI course authors the experience gained from developing CARE 1, the staff produced a Planning Manual. The first part of the Manual is a modified PERT (Program Evaluation and Review Technique) chart designed to illustrate the events and activities required to produce one hour of tutorial CAI. Author time (preparation of course content and strategies) is not included in the PERT chart.

The following averages were used to estimate the time required:

125 author program sheets;
18 audio messages;
22 images;
155 sectors; and
3700 Coursewriter II statements.

A complete discussion of events, activities, and time development can be found in Vol. IV of this Final Report.

Section Two of the Manual is a guide for programers and authors of future CAI courses. It describes the special programing "techniques" developed for the CARE course, such as answer identifiers, label and segment schemes, and restart points. It was written under the assumption that when experiences are documented, valuable time is saved because errors and inefficiencies are not repeated.

Handbook. Another form of documentation is the 400-page Handbook written especially for CARE 1. It is used by students throughout the course and contains, among other things, a 350-item glossary of critical terms. It has two functions. First, its detailed summaries for each chapter are valuable to the student as a guide while he takes the course. Second, the Handbook can be used as a reference tool and as a comprehensive outline for reviewing course content after the course has been completed. It contains charts, records, definitions, images, and a content-related reference at the end of each chapter.

Syllabus. Another form of CARE 1 documentation is the Syllabus. The Syllabus, included in this Final Report as Volume III, is in two sections. Section One describes the purpose of the course. Section Two is an outline of course content and objectives. More specifically, Section Two is a comprehensive description of the concepts which each teacher must assimilate and use in order to carry out the Decision Process.

Each page of Section Two is divided into three columns. The right column is an integrated description, chapter by chapter, of the course content in outline form. The content is roughly equivalent to information presented by means of the CRT, images, audio messages, and the Handbook. The center column contains the objectives. Objectives are listed each time a student response is required. In almost every case, an abbreviated description of the means for eliciting a student's response accompanies each objective, e.g., alt. resp. (alternate response), compl. (completion), mult. ch. (multiple choice), short ans. (short answer). Internal quizzes are also indicated (Quiz) as well as review options (Optional Review) and a series of instructional frames presenting information without requiring immediate student interaction (Information Presented).

The left column lists the modes of presentation: CRT, image, audio, Handbook, and screening devices. When images are presented in an instructional series, this is also appropriately noted.

CHAPTER V

EVALUATION

Evaluation of the CARE 1 course was conducted in two ways. The first was continuous formative evaluation which took place while the course was being developed. Objectives were devised for each chapter of the course, and each objective was evaluated using the Lindval (1967), Mager (1962), and Payne (1968) criteria. Continuous efforts were made to ensure that course material was directly related to the objectives.

Professional Consultation

Numerous informal conferences were held with faculty and staff members within The Pennsylvania State University from the following departments or programs: Computer Assisted Instruction Laboratory, Department of Special Education, Department of Elementary Education, and the Computer Science Department. These conferences, in concert with the efforts expended by the various persons more directly associated with the project, proved to be quite beneficial in developing the content and programing for the CARE course. In addition to the Penn State consultants, a number of persons were brought in from outside the University for consultation on the project. The following paragraphs describe the activities of these persons.

Professor Herbert Quay, Chairman of the Department of Educational Psychology, Temple University, Philadelphia, Pennsylvania, worked with key staff members early in the course of development of the project. Professor Quay helped establish the overall philosophy of the course and assisted in the development of the information processing model.

Professor Ralph Peabody, Department of Special Education and Rehabilitation, University of Pittsburgh, Pennsylvania, was a consultant to the project in the area of the visually handicapped. Professor Peabody helped specify the content of the chapter on the visually handicapped and also helped clarify the thinking of the investigators on other more general sections of the CARE course.

Mrs. Alma Fandal, University of Colorado Medical Center, Denver, Colorado, played a major role in the writing of the chapter on the use of the Denver Developmental Screening Tests.

Professor Steven Hunka, University of Alberta, Edmonton, Alberta, Canada, was instrumental in the development of the documentation of the CARE course. His early efforts in developing documentation routines for CAI programs have since been expanded by staff at the Penn State CAI Laboratory.

Formative Evaluation

The second stage of evaluation began after segments of the course were operational. The CARE 1 course was tested by several pilot groups of students. Fifteen students took the course in the early summer of 1970, and fifteen students took the course in the late summer of 1970. To maximize the benefit of this developmental procedure, a system for recording and revising errors was devised. Each student in the first pilot group was accompanied by a proctor who recorded on 5 x 8-inch cards the student's comments and the obvious program "bugs." (Bugs included errors in CRT text, graphic displays, images, and audio messages.) The 5 x 8-inch cards were then arranged in the correct label sequence within segments after being divided according to "concept" revisions and "program" revisions. Program revisions went immediately to the programer. Concept revisions were reviewed first by the author and then passed on to the programer, often with additional notes. The author also sent the programer certain revisions gleaned from a careful study of student responses. When all such revisions were collected, the programer revised the course segment by segment. The same procedure was followed for the second pilot group, except that the students recorded comments without the aid of a proctor.

In the fall of 1970 two advanced graduate students in special education took the course following the same recording procedures. In addition, after completing the course, these students each compiled a detailed evaluation of all the segments of the course with special emphasis on the objectives and the effectiveness with which the objectives were met.

During October and November of 1970, 115 inservice teachers from the Clearfield, Pennsylvania area took the course for full credit. Student performance records were obtained via the student performance system developed by the Penn State CAI Laboratory. The system operates automatically during the period that each student is taking a course and records data such as exact responses for each frame and specified course segment, number of requests for help during each specified course segment or sub-segment, and response latencies. Student response data are summarized either by student or by frame, segment, and course, depending on the wishes of the course author. This type of information is a valuable aid in locating sections of the course that need improvement and in making appropriate changes. A summary of the student performance data from the Clearfield group appears in Appendix G.

From this pilot group, a total of 85,718 responses was analyzed, and extensive revisions were made on the basis of the analysis.

Summative Evaluation

During the Winter Term, 1971, a summative evaluation of the CARE 1 program was made. All students who were enrolled in EEC 400, Introduction in the Education of Exceptional Children, were randomly assigned to either of two conditions--Computer-Assisted Instruction (CAI) or Conventional Instruction (CI). The CAI group (n = 27) received all instruction by means of the IBM 1500 Instructional System and did not attend classes with the CI group. The CI group (n = 87) received the conventional lecture-discussion method of instruction and met three days per week in 75 minute sessions for ten weeks.

All students, CAI and CI, were enrolled as regular students for three credits of undergraduate or graduate credit. Both the CAI and CI courses were designed to reach the same objectives. The instructor of the CI group was an author of the CAI course and helped plan the structure and the objectives for the CAI course.

The dependent variables in this investigation were time and final examination scores based on 75 items. Results are shown on the following page in Figure 3.

These data indicate that the students instructed by CAI obtained a mean score of 24% higher on the final examination than did those students instructed

Final Examination Scores

	$\overline{X}$	S. D.	t
Computer-Assisted Instruction	69.59	4.68	
Conventional Instruction	52.78	5.89	11.65*

*This difference is statistically significant with $p < .001$.

Time

Computer-Assisted Instruction	$\overline{X}$ = 25.21 hours per student
Conventional Instruction	37.5 scheduled hours per student

Fig. 3. Results of CAI-CI comparative evaluation.

in the conventional manner. Furthermore, the CAI students completed the three-credit course in 12 hours less time (33%) than the conventionally instructed students.

Site Evaluation

A three-member Site Visit Team from the Bureau of Educational Personnel Development observed the program in operation at its location in Smethport, Pennsylvania, on March 10-12, 1971. Excerpts from their report are included in Appendix H.

Adoption by the University of Texas

In the spring of 1971 the course was evaluated by the University of Texas Department of Special Education and the University of Texas CAI Center. Twenty advanced graduate students in special education took the entire course and recorded their comments. As a result of this evaluation, the University has decided to offer the course to twenty rural educators from El Paso, Texas in the summer of 1971. In addition, arrangements are being made to incorporate CARE 1 as a regular part of the undergraduate curriculum in special education.

Council for Exceptional Children

The Mobile Laboratory with the CARE 1 course was exhibited at the international meeting of the Council for Exceptional Children in Miami Beach, Florida. This trip was sponsored by the USOE Bureau of Education for the Handicapped and Bureau of Educational Personnel Development.

The Laboratory was open for inspection in front of the Fontainebleau Hotel from April 19-23 for approximately twelve hours each day. During this period a total of 2,920 persons visited the Laboratory and received printed material about the CARE program. It is estimated that 90% of the visitors had the opportunity to sit at a student terminal and participate in a portion of the course. The records show that 765.5 terminal hours were provided during the period. This is an average of about fifteen minutes for each person who took a section of the course.

The visitors were quite enthused, and most spoke in glowing terms about the project. Representative comments are shown in Appendix I. It is noteworthy to note that many of the visitors who began one section of the course became interested enough to return to finish it at a later time.

Student Opinion Survey (SOS)

The evaluation of CARE 1 has been both formative and summative in nature. It has been formative in the sense that revisions and modifications have continually been made in the course while it has been in the field. This formative evaluation has been based on information gained from the analysis of student performance records, final examination subtest scores, student comments, and the Student Opinion Survey (SOS).

The Student Opinion Survey is a 42-item questionnaire administered online following the final examination. The survey deals with statements about student attitudes toward computer-assisted instruction, the operation of the equipment, likes and dislikes of the course, and student's feelings in general about the learning situation. Examples of these questions can be found in Appendix J.

The Student Opinion Survey also serves as part of the summative evaluation of the CARE 1 course. (See Appendices K and L.)

Research has shown that student attitudes toward the method of instruction may play a significant part in learning and transfer (Gage, 1963). If the student has a favorable attitude toward a learning situation, there is a better chance that he will want to learn more about the subject. More important, a student with a favorable attitude will probably be more inclined to apply what he has learned to the daily situation--in this particular case, the elementary classroom.

The Student Opinion Survey, therefore, plays a significant role in the summative evaluation of CARE 1.

In its original form, the Student Opinion Survey was a pencil and paper questionnaire (Brown, 1966). It has since been adapted to on-line administration (Borman, 1969). It has also been modified to allow a student to type free response comments after each item in order to clarify or explain his reason for scoring a particular statement high, low, or neutral (Borman, 1969).

Students evaluate each statement by depressing the light pen along a coded line on the cathode ray tube to indicate the degree to which they agree (strongly agree . . . . strongly disagree) with a statement or the extent that they thought the statement applied (all of the time . . . . never). Students were told at the beginning of the Student Opinion Survey to be frank with their evaluation and comments.

Student responses were scored on an 8-point scale, with 8 indicating the most favorable attitude and 1 indicating the least favorable attitude. The range of possible scores was from 42 to 336, and a score of 189 would be considered the median or a theoretically neutral score. The higher the total score the more favorable the student's attitude toward CAI.

Students could type comments up to 200 characters in length after each of the 42 statements in the questionnaire. In addition, at the end of the 42-item questionnaire, the students were given a final opportunity to comment on any facets of the CARE 1 course or CAI in general that might not have been covered by the SOS items or that they may have forgotten to record. These comments were then analyzed as part of a student's total SOS score. In connection with the SOS scores, the comments were used as an explanation for extremely high or extremely low scores for any particular question or group of questions in the SOS. The comments provided valuable information to the staff with reference to possible course modifications or changes in operational procedures.

A copy of the Student Opinion Survey, along with a breakdown of student's responses to each question at each of four locations appears in Appendix J. In addition, student comments are supplied from each location to explain trends that might be high, low, or neutral.

CHAPTER VI

SUMMARY

It was the purpose of this project to develop a complete college level computer-assisted instruction (CAI) course dealing with the identification of handicapping conditions in children. The end produce was a CAI course called Computer Assisted Remedial Education (CARE). The purpose of CARE is to give educational personnel the knowledge and skills necessary to deal effectively with children who have educational problems. Under separate funding arrangements, the CARE course is now being offered for three college credits to inservice teachers in the various parts of Pennsylvania and other states.

Several stages of development were required to produce the CARE course. First, an intensive review of the relevant literature was carried out in the early stages of the project. Approximately 2,000 journal articles and over 50 books were reviewed by the various course authors and graduate assistants in order to identify the most current thinking in the field. Subsequent course curriculum development was based on the literature review with assistance from consultants. As the course authors prepared the sequences of instruction, the educational programers translated the Coursewriter II language for use with the IBM 1500 Instructional System. Both authors and programers tested course sequence for smoothness and credibility before a pilot group of students took the course for debugging purposes. After the pilot group took the course, extensive revisions were made, and a second pilot group assisted in the evaluation of the CAI program. These pilot groups plus other formative evaluation procedures have been instrumental in producing a CAI course which is internally valid and error free.

Summative evaluations have shown that students who take the CAI course score significantly higher in achievement and take about one third less time to cover the same objectives than students instructed in the conventional lecture-discussion method.

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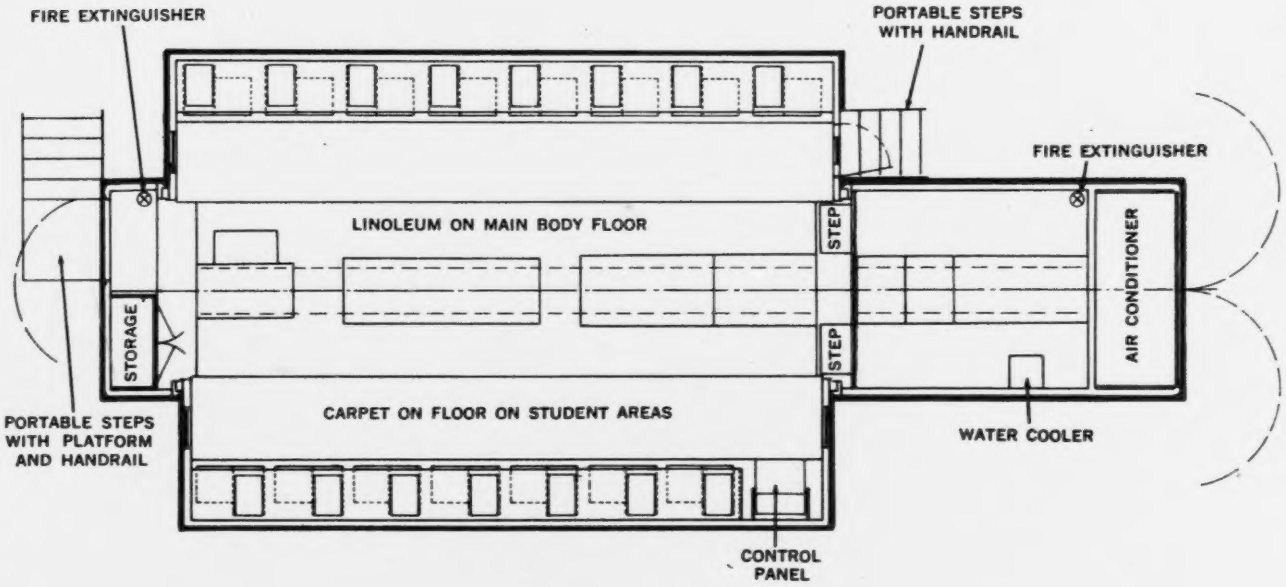
APPENDIX A

Mobile Laboratory Specifications

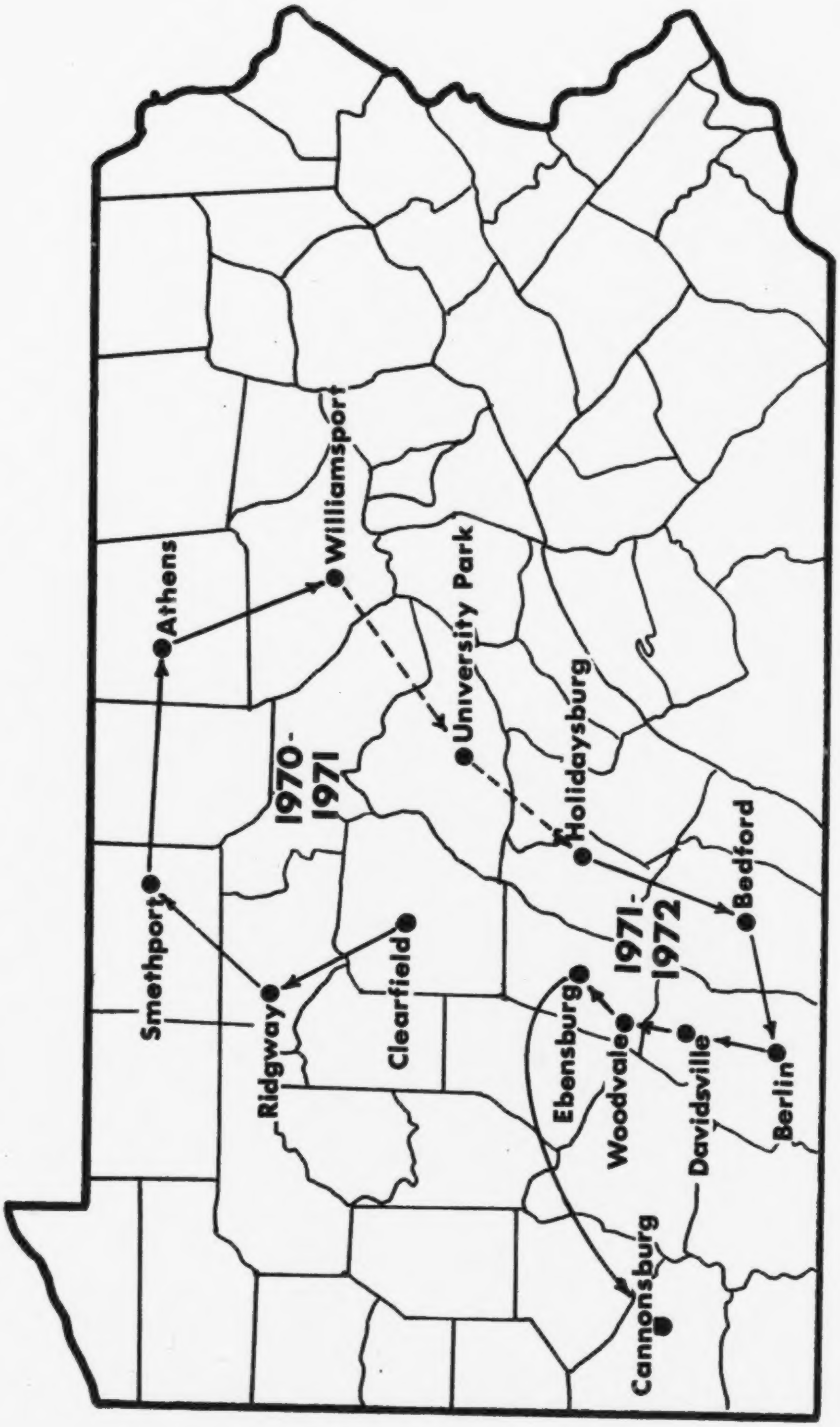
VEHICLE SPECIFICATIONS

Length: 40′-0″	**Overall Exterior when in Transit.**
Height: 12′-6″	**Overall Exterior when in Transit.**
Width: 8′-0″	**Overall Exterior when in Transit.**
Closed: 88½″	**Inside Width when in Transit.**
Expanded: 204″ (17′)	**Inside Width when in Operation.**


FIRE EXTINGUISHER
PORTABLE STEPS WITH HANDRAIL
FIRE EXTINGUISHER
LINOLEUM ON MAIN BODY FLOOR
STEP
STEP
AIR CONDITIONER
STORAGE
CARPET ON FLOOR ON STUDENT AREAS
PORTABLE STEPS WITH PLATFORM AND HANDRAIL
WATER COOLER
CONTROL PANEL

APPENDIX B

Site Locations for Mobile Laboratory


1970-1971
Smethport
Athens
Williamsport
University Park
Holidaysburg
Ridgway
Clearfield
1971-1972
Bedford
Berlin
Davidsville
Woodvale
Ebensburg
Cannonsburg

APPENDIX C

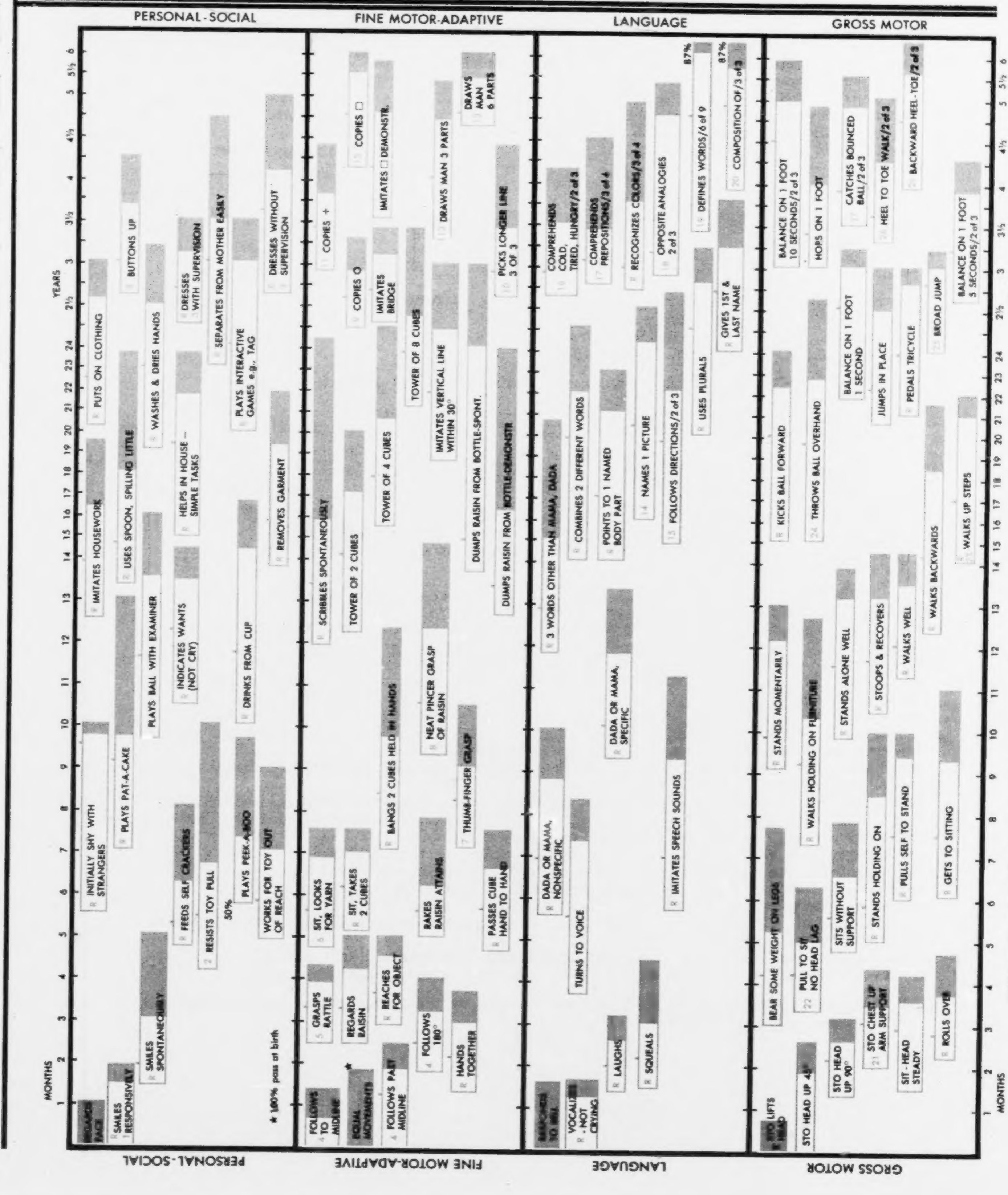
Denver Developmental Screening Test Form

DENVER DEVELOPMENTAL SCREENING TEST

STO. = STOMACH
SIT = SITTING

PERCENT OF CHILDREN PASSING
25 50 75 90
May pass by report →
Footnote No. - see back of form →
Test Item

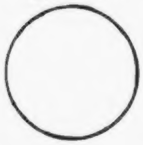
Date
Name
Birthdate
Hosp. No.



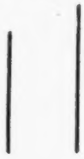
©1969, William K. Frankenburg, M.D. and Josiah B. Dodds, Ph.D., University of Colorado Medical Center.

DATE
NAME
DIRECTIONS
BIRTHDATE
HOSP. NO.

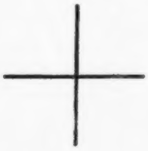
1. Try to get child to smile by smiling, talking or waving to him. Do not touch him.
2. When child is playing with toy, pull it away from him. Pass if he resists.
3. Child does not have to be able to tie shoes or button in the back.
4. Move yarn slowly in an arc from one side to the other, about 6" above child's face. Pass if eyes follow 90° to midline. (Past midline; 180°)
5. Pass if child grasps rattle when it is touched to the backs or tips of fingers.
6. Pass if child continues to look where yarn disappeared or tries to see where it went. Yarn should be dropped quickly from sight from tester's hand without arm movement.
7. Pass if child picks up raisin with any part of thumb and a finger.
8. Pass if child picks up raisin with the ends of thumb and index finger using an over hand approach.



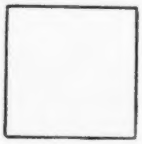
9. Pass any enclosed form. Fail continuous round motions.



10. Which line is longer? (Not bigger.) Turn paper upside down and repeat. (3/3 or 5/6)



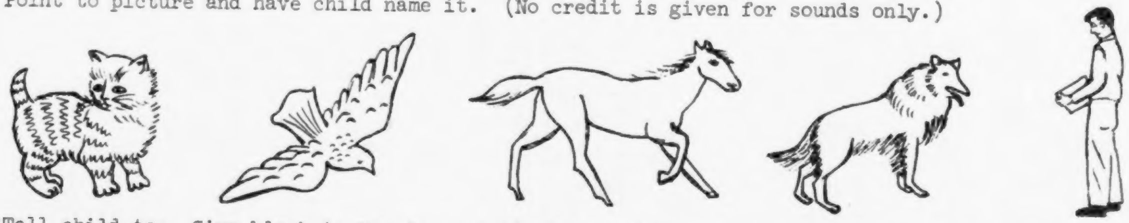
11. Pass any crossing lines.



12. Have child copy first. If failed, demonstrate

When giving items 9, 11 and 12, do not name the forms. Do not demonstrate 9 and 11.

13. When scoring, each pair (2 arms, 2 legs, etc.) counts as one part.
14. Point to picture and have child name it. (No credit is given for sounds only.)

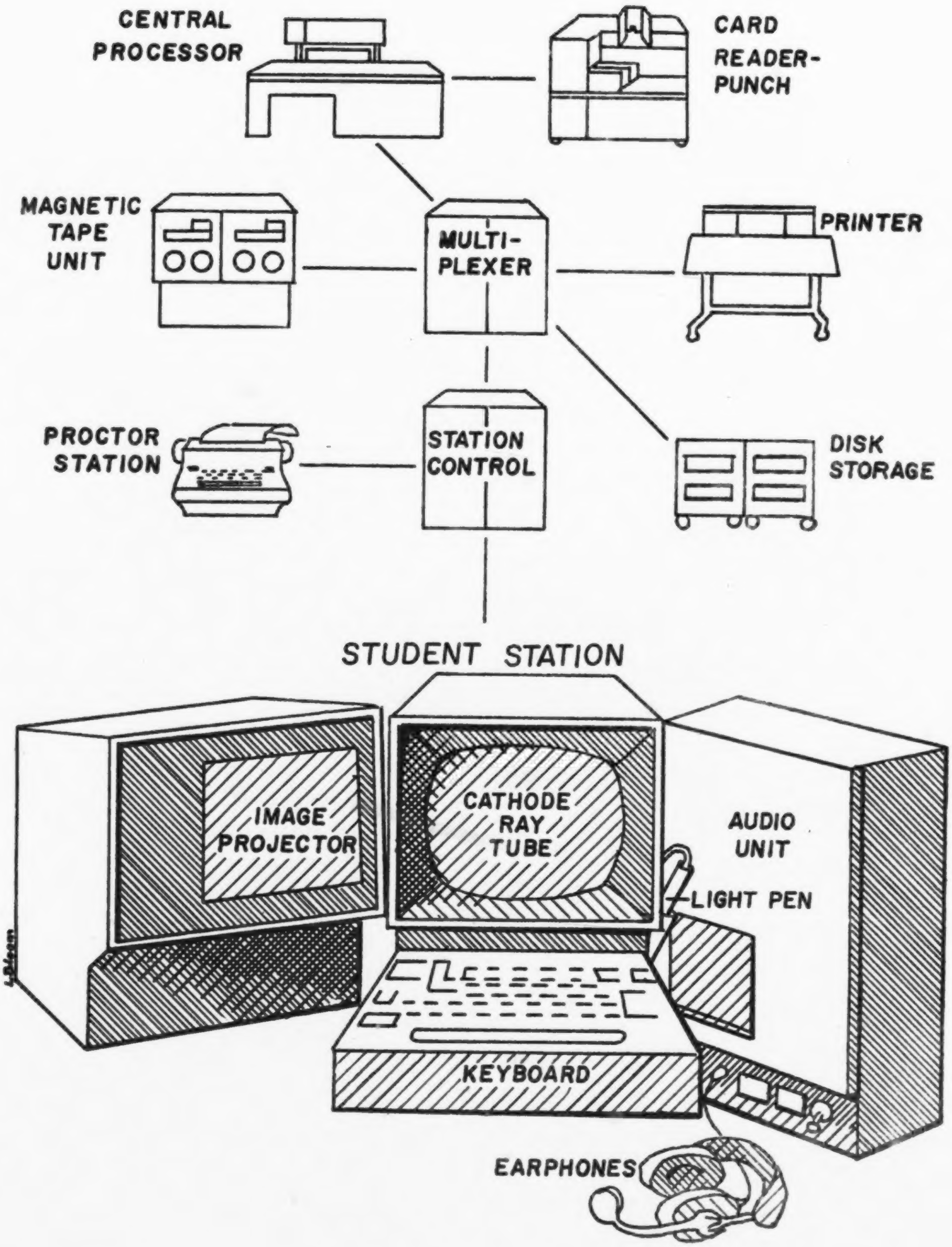


15. Tell child to: Give block to Mommie; put block on table; put block on floor. Pass 2 of 3. (Do not help child by pointing, moving head or eyes.)
16. Ask child: What do you do when you are cold? ..hungry? ..tired? Pass 2 of 3.
17. Tell child to: Put block on table; under table; in front of chair, behind chair. Pass 3 of 4. (Do not help child by pointing, moving head or eyes.)
18. Ask child: If fire is hot, ice is ?; Mother is a woman, Dad is a ?; a horse is big, a mouse is ?. Pass 2 of 3.
19. Ask child: What is a ball? ..lake? ..desk? ..house? ..banana? ..curtain? ..ceiling? ..hedge? ..pavement? Pass if defined in terms of use, shape, what it is made of or general category (such as banana is fruit, not just yellow). Pass 6 of 9.
20. Ask child: What is a spoon made of? ..a shoe made of? ..a door made of? (No other objects may be substituted.) Pass 3 of 3.
21. When placed on stomach, child lifts chest off table with support of forearms and/or hands.
22. When child is on back, grasp his hands and pull him to sitting. Pass if head does not hang back.
23. Child may use wall or rail only, not person. May not crawl.
24. Child must throw ball overhand 3 feet to within arm's reach of tester.
25. Child must perform standing broad jump over width of test sheet. (8-1/2 inches)
26. Tell child to walk forward, ⊂⊃⊂⊃⊂⊃⊂⊃→ heel within 1 inch of toe. Tester may demonstrate. Child must walk 4 consecutive steps, 2 out of 3 trials.
27. Bounce ball to child who should stand 3 feet away from tester. Child must catch ball with hands, not arms, 2 out of 3 trials.
28. Tell child to walk backward, ←⊂⊃⊂⊃⊂⊃⊂⊃ toe within 1 inch of heel. Tester may demonstrate. Child must walk 4 consecutive steps, 2 out of 3 trials.

DATE AND BEHAVIORAL OBSERVATIONS (how child feels at time of test, relation to tester, attention span, verbal behavior, self-confidence, etc,):

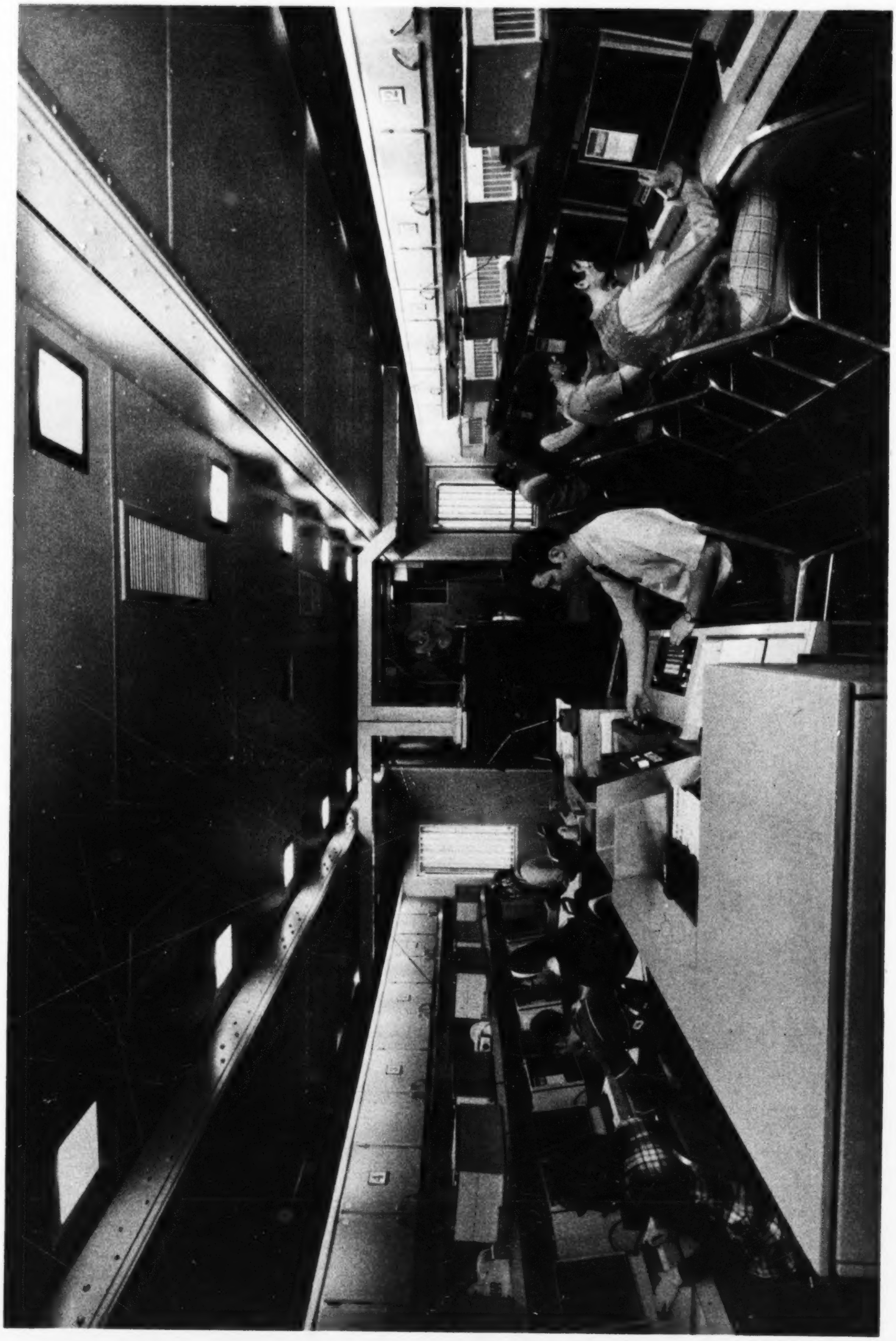
APPENDIX D

IBM 1500 System Configuration


CENTRAL PROCESSOR
CARD READER-PUNCH
MAGNETIC TAPE UNIT
MULTI-PLEXER
PRINTER
PROCTOR STATION
STATION CONTROL
DISK STORAGE
STUDENT STATION
IMAGE PROJECTOR
CATHODE RAY TUBE
AUDIO UNIT
LIGHT PEN
KEYBOARD
EARPHONES

APPENDIX E

Interior and Exterior Views of the Mobile Laboratory



Interior View of Mobile CAI Laboratory

ISYLVANIA
E
ERSITY
Continuing Education Services
THE PENNSYLVANIA STATE UNIVERS

Exterior View of Mobile CAI Laboratory

APPENDIX F

DOCUMENT:
A System for the Documentation of CAI Courses

James J. Watts
Research Assistant

DOCUMENT:

A System for the Documentation of CAI Courses

In the field of computer-assisted instruction, there is a growing concern about the need for effective course documentation. With the increase in the number and sophistication of developed courses, dissemination of information on content and strategies becomes more necessary. One result of the lack of good documentation is needless duplication. Instead of using already existing courses, many developers go through the tedious process of building a new course from the ground up.

If a documentation system is to perform its function effectively, it must be suitable for several distinct audiences. In The Pennsylvania State University's DOCUMENT system, essential information concerning the content and strategies of a course is made available to potential consumers, course programers, non-programers, and instructors. Each of these groups places different demands upon the documentor, and only when all of these demands can be met is a documentation program functional. Penn State's DOCUMENT confronts each of these levels, seeking to provide information of maximum value to all four audiences.

The first audience, the potential consumer, is made up of those concerned with the events taking place at other CAI facilities and interested in obtaining useful courses. Since the dissemination of courses presents a problem, as does the compatibility to a variety of machine configurations, models, and languages, potential consumers are reluctant to expend the time and effort to obtain courses from other installations. This constrains widespread use of an already developed course.

It is in solving this problem that printed documentation can be of value. For potential consumers, printed documentation provides a concise and accurate description of a course and may be consulted without special equipment or technical knowledge. Using this description, a potential consumer can determine the merits and drawbacks of a course and can judge whether or not the course is suitable for his own installation.

The first section of course documentation produced by DOCUMENT, which is a transformation of Coursewriter II code into an understandable English representation of the course, is important for both programers and non-programers. The format consists of a representation of the CRT screen display together with a description of how student answers are processed. Each new screen display, with its label and any pauses used, is also presented.

In Figure 4, the screen display labeled A054HM is presented after a half-second pause. Rows and columns are numbered to serve as points of reference. The apostrophes over "a," "b," and "c" in the answer choices indicate that these three letters are alternate-coded. (Alternate coded characters appear as dark characters on a light background on a cathode ray tube.) Below the screen display, DOCUMENT lists the type of response required from the student and the amount of time allowed for an answer to be submitted. (In Figure 4, a light pen response is required, with the amount of time being determined by the system latency time previously established. The course program then calls for 4 rows to be erased to leave room for feedback to the student. A one-half second pause follows.)

In Figure 4, "a" is the correct answer, and the lines "RIGHT. + .86 IS NEAR + 1.0, SO IT IS HIGH AND IT IS POSITIVE" are displayed in the feedback area previously cleared on the screen. The student then moves to the next frame. Answers "b" and "c" are WRONG ANSWERS, and the feedback for each answer is indicated. After the feedback, the program returns the student to the original question. If the student has not given any of these three answers, he gets the feedback response for an "unrecognizable answer." The program then reverts to the original question position, and the student is ready to answer again.

In addition to the material in Figure 4, other features are included in the DOCUMENT system. The use of audio is indicated by a message such as "PLAY AUDIO MESSAGE AAAAA," where AAAAA is the symbolic audio name. If an emphasis mark is included, the message "CONTINUE AUDIO MESSAGE AAAAA" is printed. If the audio uses an absolute address instead of symbolic, then AAAAA is replaced by the constant symbol ABSOL. The use of film images is shown by several messages which indicate the opening and closing of the shutter, the positioning of the film, and the number of the frame to be displayed. Branches are shown by a message "GO TO LLLLL" where LLLLL is the label in the course to which control is passed. If a condition must be present for a branch to take place, it is indicated by a message such as "GO TO LLLLL IF COUNTER NN IS EQUAL TO XXX," where NN is the counter number and XXX is the value which is being tested for. This section of DOCUMENT offers both the programer and non-programer a sequential and graphical representation of a course.

The second part of DOCUMENT, as shown in Figure 5, is a listing of the actual Coursewriter II statements. The headings on each page include course name and segment, date and time of day of the DOCUMENT run, and pagination. For example, in Figure 5, the course CARE 1 segment 11 was run through DOCUMENT at 24 seconds past 7:18 a.m. on January 17, 1971. The body of the page, from left to right, contains a sequential count of all input Coursewriter statements, the label-sequence number of each statement, and a reproduction of the input card or cards associated with each statement. For example, in Figure 5, statement number 1396 corresponds to the 1396th Coursewriter statement on the input cards with a label-sequence number of A054IC-7. The Coursewriter statement DE 0>/32 results in a complete clearing of the display screen. This listing can thus be used in conjunction with the graphic display of the course to make modifications and to visualize how a display will be observed by the student. By cross-referencing between a label on the course listing and the frame labels in the graphic section, the programer can find the correspondence between the Coursewriter code and the graphic representation.

The third part of DOCUMENT, which is also of interest to the programer, is a cross-referenced table illustrating which audio, buffers, counters, functions, film images, labels, macros, return registers, switches, and counters used as switches have been used and where they have been used. In the case of labels, this part of DOCUMENT indicates where they have been defined. The format for this table produces, from left to right, the symbol of the item to be cross-referenced followed by a one-letter code to identify the type of symbol. In the case of labels only, the statement number which corresponds to the location where the label was defined is listed next. Then, in all cases, the next ten columns contain the label-sequence number of all statements in the course in which the symbol at the left was used. Figure 6 contains an illustration. In this case, llprl0 is a label defined in statement number 310 and referenced at only one other point in the course, namely PROCES-25. PSADD1, on the other hand, is a macro which is referenced in 101 locations in the course.

This cross-referenced table has several levels of ordering. First, each category of symbols is grouped together. Then, within each group, the symbols themselves are ordered alphabetically, with the label-sequence numbers also alphabetically ordered within each symbol.

A documentation system is also a useful aid to an instructor in the preparation of material to be used in teaching a conventional course in the same or related subject matter. In effect, the system presents the instructor with a course outline, contents, questions, and exams. On this basis, the instructor may then modify, extend, or accept the material without taking the time and energy to find and organize the material from the beginning.

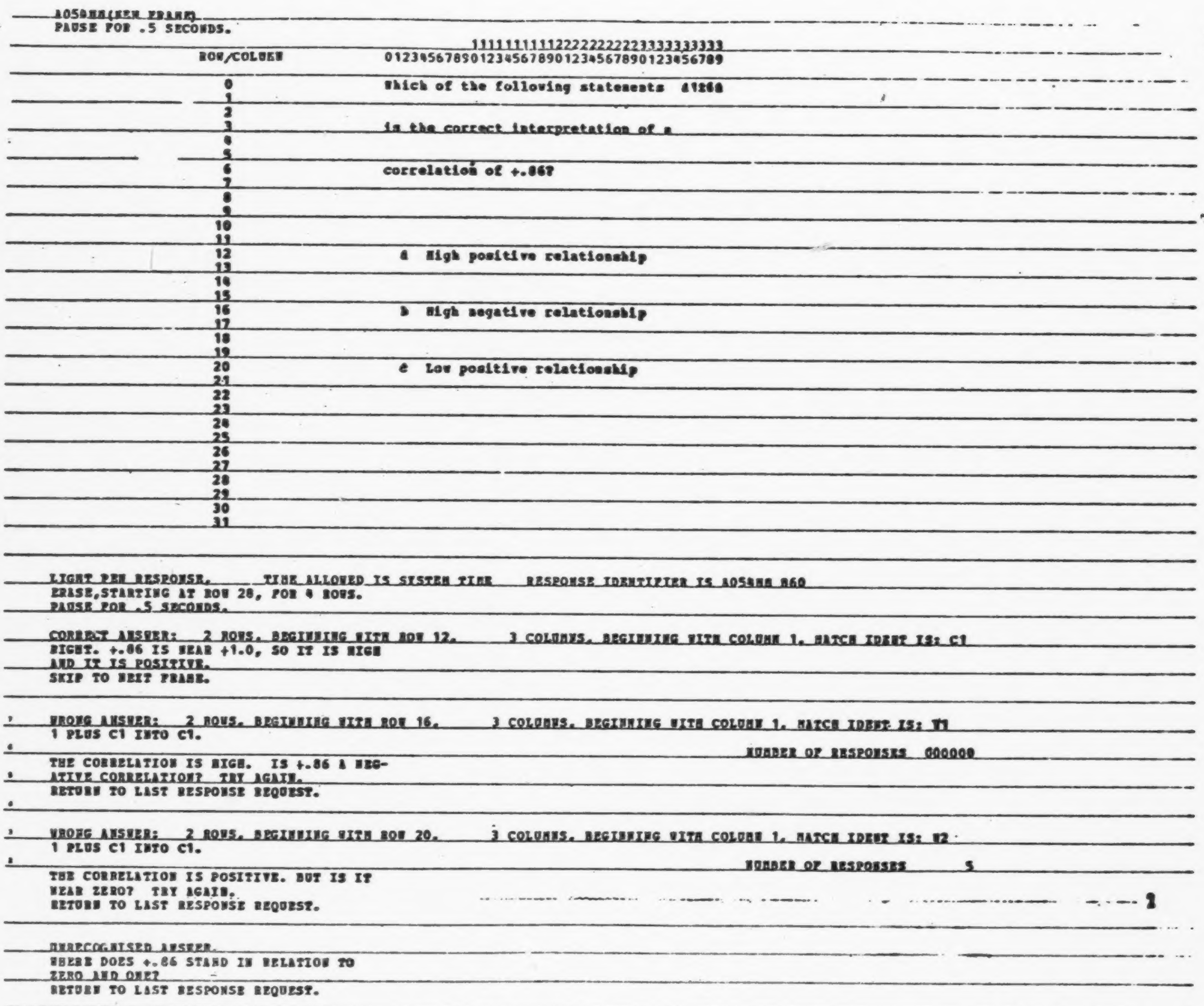
DOCUMENT is programed in PL/1 for an IBM System 360/67. However, the program was designed so that it would be compatible with any 360 system containing a standard PL/1 compiler. This provides for the use of DOCUMENT in a large number of installations. Work on the original documentation system was begun by Richard Thompson in January 1970. The branching logic, which the system accepts, was added by Fred Chase in April 1970. The present version of the system was developed during the fall of 1970. It includes such things as a conversion of output into upper and lower case, an allowance for more than one course to be processed in a single computer run, the addition of a symbol cross-reference listing, and a decrease in the amount of time required to execute the program.

The DOCUMENT system requires the use of several input/output devices. Input to the system may come in the form of punched cards or magnetic tape, with the number of courses or segments which can be processed at a single time limited only by the amount of time and records available at the computer installation. There is no limit to the number of statements in the course to be documented.

There are two distinct sets of output produced by the DOCUMENT system. The first two sets are tape output. One tape is used to contain the graphic document output, with one tape file containing each documented section. The second tape is used to contain the course listing and cross-referenced table, again with one tape file containing each documented section. This splits the output necessary for both programers and non-programers. A listing of the appropriate tape, therefore, need only result in the output for the required group.

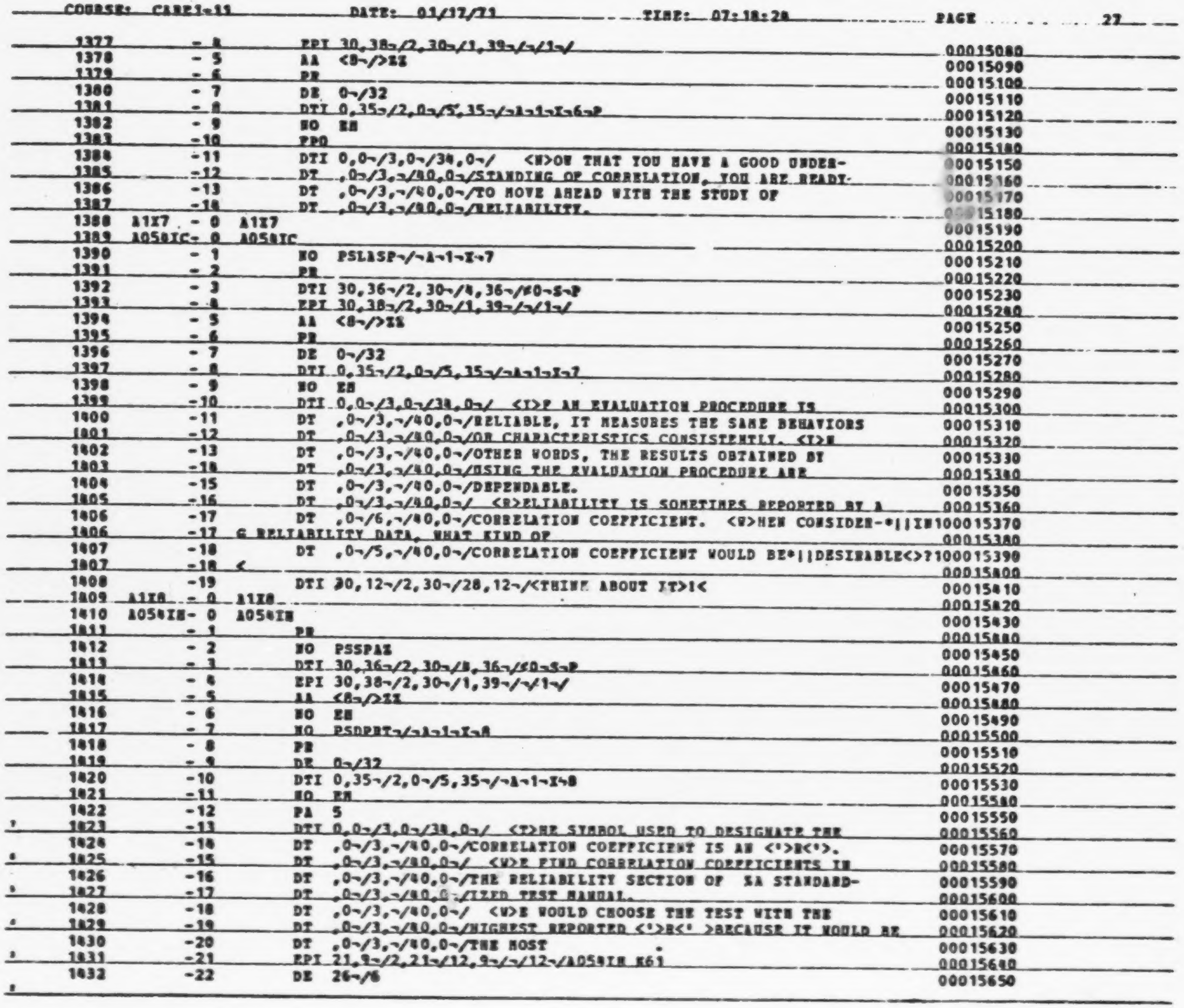
Several temporary disk storage areas are required for the sorting procedure, which is accomplished by the standard IBM SORT MERGE program. The DOCUMENT system is currently in active use at Penn State. Presently, the cost for documenting a course is approximately 1.16¢ per Coursewriter II statement. The exact cost is installation-variable but should remain in close proximity to the above figure. The amount of output in terms of lines printed can be approximated by the formula 6.8 times the number of Coursewriter statements. This figure is based on a complete listing of the three sections of documentation (graphic documentation, coursewriter listings, and cross-reference).

The DOCUMENT system offers a variety of information to all users, and this information is presented in readable, easily interpreted form. Always dynamic in nature, however, DOCUMENT can look forward to greater refinements in the future. Anticipated revisions include such additions as a copy of the actual text in audio messages and a decrease in the amount of time required for each Coursewriter statement. In the meantime, DOCUMENT is an efficiently operating system producing a unique analysis of Coursewriter II code.



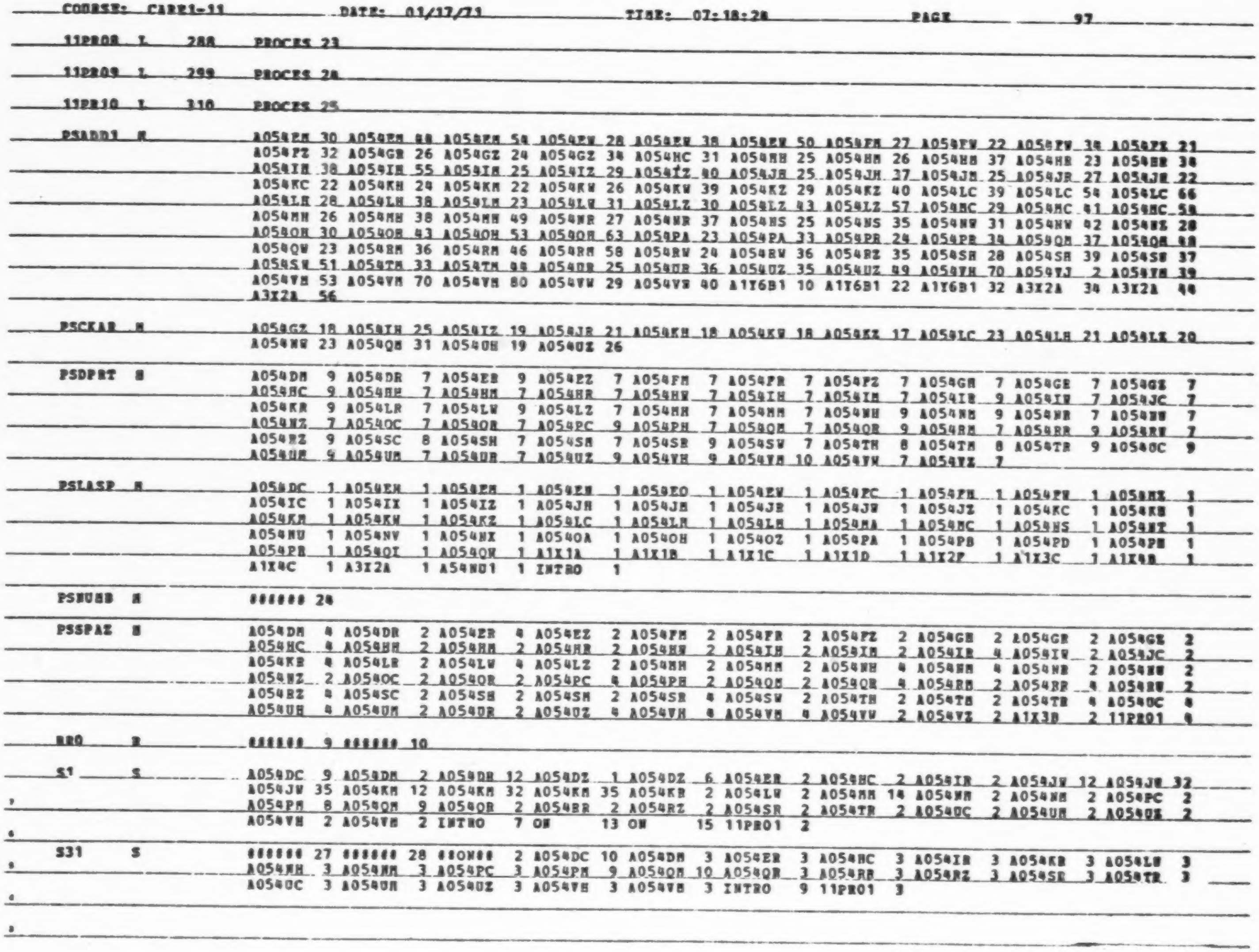
```
A05ANN(NEW FRAME)
PAUSE FOR .5 SECONDS.
                                            111111111122222222223333333333
                       ROW/COLUMN     0123456789012345678901234567890123456789

                            0         Which of the following statements  A1260
                            1
                            2
                            3         is the correct interpretation of a
                            4
                            5
                            6         correlation of +.86?
                            7
                            8
                            9
                           10
                           11
                           12          a  High positive relationship
                           13
                           14
                           15
                           16          b  High negative relationship
                           17
                           18
                           19
                           20          c  Low positive relationship
                           21
                           22
                           23
                           24
                           25
                           26
                           27
                           28
                           29
                           30
                           31


LIGHT PEN RESPONSE.      TIME ALLOWED IS SYSTEM TIME    RESPONSE IDENTIFIER IS A05ANN A60
ERASE,STARTING AT ROW 28, FOR 4 ROWS.
PAUSE FOR .5 SECONDS.

CORRECT ANSWER:   2 ROWS. BEGINNING WITH ROW 12.     3 COLUMNS. BEGINNING WITH COLUMN 1. MATCH IDENT IS: C1
RIGHT. +.86 IS NEAR +1.0, SO IT IS HIGH
AND IT IS POSITIVE.
SKIP TO NEXT FRAME.

WRONG ANSWER:   2 ROWS. BEGINNING WITH ROW 16.     3 COLUMNS. BEGINNING WITH COLUMN 1. MATCH IDENT IS: W1
1 PLUS C1 INTO C1.
                                                                        NUMBER OF RESPONSES  000000
THE CORRELATION IS HIGH.  IS +.86 A NEG-
ATIVE CORRELATION?  TRY AGAIN.
RETURN TO LAST RESPONSE REQUEST.

WRONG ANSWER:   2 ROWS. BEGINNING WITH ROW 20.     3 COLUMNS. BEGINNING WITH COLUMN 1. MATCH IDENT IS: W2
1 PLUS C1 INTO C1.
                                                                        NUMBER OF RESPONSES       5
THE CORRELATION IS POSITIVE. BUT IS IT
NEAR ZERO?  TRY AGAIN.
RETURN TO LAST RESPONSE REQUEST.

UNRECOGNISED ANSWER.
WHERE DOES +.86 STAND IN RELATION TO
ZERO AND ONE?
RETURN TO LAST RESPONSE REQUEST.
```

Fig. 4. Screen display presented after a half-second pause.



```
COURSE: CARE1-11          DATE: 01/17/71          TIME: 07:18:28          PAGE ........ 27
  1377          - 4      EPI 30,38¬/2,30¬/1,39¬/¬/1¬/                          00015080
  1378          - 5      AA  <8¬/>ZZ                                           00015090
  1379          - 6      PR                                                    00015100
  1380          - 7      DE  0¬/32                                             00015110
  1381          - 8      DTI 0,35¬/2,0¬/5,35¬/¬A¬1¬X¬6¬P                       00015120
  1382          - 9      NO  EN                                                00015130
  1383          -10      PPO                                                   00015140
  1384          -11      DTI 0,0¬/3,0¬/34,0¬/   <N>OW THAT YOU HAVE A GOOD UNDER-   00015150
  1385          -12      DT  ,0¬/3,¬/40,0¬/STANDING OF CORRELATION, YOU ARE READY-  00015160
  1386          -13      DT  ,0¬/3,¬/40,0¬/TO MOVE AHEAD WITH THE STUDY OF    00015170
  1387          -14      DT  ,0¬/3,¬/40,0¬/RELIABILITY.                        00015180
  1388  A1X7    - 0  A1X7                                                      00015190
  1389  A050IC- 0  A050IC                                                      00015200
  1390          - 1      NO  PSLASP¬/¬A¬1¬X¬7                                  00015210
  1391          - 2      PR                                                    00015220
  1392          - 3      DTI 30,36¬/2,30¬/4,36¬/≠0¬S¬P                         00015230
  1393          - 4      EPI 30,38¬/2,30¬/1,39¬/¬/1¬/                          00015240
  1394          - 5      AA  <8¬/>ZZ                                           00015250
  1395          - 6      PR                                                    00015260
  1396          - 7      DE  0¬/32                                             00015270
  1397          - 8      DTI 0,35¬/2,0¬/5,35¬/¬A¬1¬X¬7                         00015280
  1398          - 9      NO  EN                                                00015290
  1399          -10      DTI 0,0¬/3,0¬/34,0¬/  <I>F AN EVALUATION PROCEDURE IS   00015300
  1400          -11      DT  ,0¬/3,¬/40,0¬/RELIABLE, IT MEASURES THE SAME BEHAVIORS  00015310
  1401          -12      DT  ,0¬/3,¬/40,0¬/OR CHARACTERISTICS CONSISTENTLY. <I>N  00015320
  1402          -13      DT  ,0¬/3,¬/40,0¬/OTHER WORDS, THE RESULTS OBTAINED BY  00015330
  1403          -14      DT  ,0¬/3,¬/40,0¬/USING THE EVALUATION PROCEDURE ARE   00015340
  1404          -15      DT  ,0¬/3,¬/40,0¬/DEPENDABLE.                         00015350
  1405          -16      DT  ,0¬/3,¬/40,0¬/  <R>ELIABILITY IS SOMETIMES REPORTED BY A  00015360
  1406          -17      DT  ,0¬/6,¬/40,0¬/CORRELATION COEFFICIENT.  <W>HEN CONSIDER-*||IN100015370
  1406          -17  G RELIABILITY DATA, WHAT KIND OF                            00015380
  1407          -18      DT  ,0¬/5,¬/40,0¬/CORRELATION COEFFICIENT WOULD BE*||DESIRABLE<>?100015390
  1407          -18  <                                                         00015400
  1408          -19      DTI 30,12¬/2,30¬/28,12¬/<THINK ABOUT IT>1<            00015410
  1409  A1X8    - 0  A1X8                                                      00015420
  1410  A054IN- 0  A054IN                                                      00015430
  1411          - 1      PR                                                    00015440
  1412          - 2      NO  PSSPAZ                                            00015450
  1413          - 3      DTI 30,36¬/2,30¬/4,36¬/≠0¬S¬P                         00015460
  1414          - 4      EPI 30,38¬/2,30¬/1,39¬/¬/1¬/                          00015470
  1415          - 5      AA  <8¬/>ZZ                                           00015480
  1416          - 6      NO  EN                                                00015490
  1417          - 7      NO  PSDPET¬/¬A¬1¬X¬8                                  00015500
  1418          - 8      PR                                                    00015510
  1419          - 9      DE  0¬/32                                             00015520
  1420          -10      DTI 0,35¬/2,0¬/5,35¬/¬A¬1¬X¬8                         00015530
  1421          -11      NO  EN                                                00015540
  1422          -12      PA  5                                                 00015550
  1423          -13      DTI 0,0¬/3,0¬/34,0¬/  <T>HE SYMBOL USED TO DESIGNATE THE  00015560
  1424          -14      DT  ,0¬/3,¬/40,0¬/CORRELATION COEFFICIENT IS AN <'>R<'>.  00015570
  1425          -15      DT  ,0¬/3,¬/40,0¬/  <W>E FIND CORRELATION COEFFICIENTS IN  00015580
  1426          -16      DT  ,0¬/3,¬/40,0¬/THE RELIABILITY SECTION OF  XA STANDARD-  00015590
  1427          -17      DT  ,0¬/3,¬/40,0¬/IZED TEST MANUAL.                   00015600
  1428          -18      DT  ,0¬/3,¬/40,0¬/  <W>E WOULD CHOOSE THE TEST WITH THE  00015610
  1429          -19      DT  ,0¬/3,¬/40,0¬/HIGHEST REPORTED <'>R<' >BECAUSE IT WOULD BE  00015620
  1430          -20      DT  ,0¬/3,¬/40,0¬/THE MOST                            00015630
  1431          -21      EPI 21,9¬/2,21¬/12,9¬/¬/12¬/A054IN X61                00015640
  1432          -22      DE  26¬/6                                             00015650
```

Fig. 5. A listing of the actual Coursewriter II statements.



```
COURSE: CARE1-11          DATE: 01/17/73          TIME: 07:18:28          PAGE      97
11PR08  L   288   PROCES 23
11PR09  L   299   PROCES 24
11PR10  L   310   PROCES 25
PSADD1  M         A054EM 30 A054EM 44 A054EM 54 A054EW 28 A054EW 38 A054EW 50 A054FM 27 A054FW 22 A054FW 34 A054FX 21
                  A054FZ 32 A054GR 26 A054GZ 24 A054GZ 34 A054HC 31 A054HH 25 A054HM 26 A054HR 37 A054HR 23 A054HR 34
                  A054IH 38 A054IH 55 A054IM 25 A054IZ 29 A054IZ 40 A054JH 25 A054JM 37 A054JM 25 A054JR 27 A054JR 22
                  A054KC 22 A054KH 24 A054KM 22 A054KW 26 A054KW 39 A054KZ 29 A054KZ 40 A054LC 39 A054LC 54 A054LC 66
                  A054LH 28 A054LH 38 A054LM 23 A054LW 31 A054LZ 30 A054LZ 43 A054LZ 57 A054MC 29 A054MC 41 A054MC 58
                  A054MH 26 A054MH 38 A054MM 49 A054NR 27 A054NR 37 A054NS 25 A054NS 35 A054NW 31 A054NW 42 A054NZ 28
                  A054OH 30 A054OH 43 A054OH 53 A054OH 63 A054PA 23 A054PA 33 A054PR 24 A054PR 34 A054QM 37 A054QM 48
                  A054QW 23 A054RM 36 A054RM 46 A054RM 58 A054RW 24 A054RW 36 A054RZ 35 A054SH 28 A054SH 39 A054SW 37
                  A054SW 51 A054TM 33 A054TM 44 A054UR 25 A054UR 36 A054UZ 35 A054UZ 49 A054VH 70 A054VJ  2 A054VM 39
                  A054VH 53 A054VM 70 A054VM 80 A054VW 29 A054VW 40 A1Y6B1 10 A1Y6B1 22 A1Y6B1 32 A3X2A  34 A3X2A  44
                  A3X2A  56
PSCKAR  M         A054GZ 18 A054IH 25 A054IZ 19 A054JR 21 A054KH 18 A054KW 18 A054KZ 17 A054LC 23 A054LH 21 A054LX 20
                  A054NW 23 A054QH 31 A054UH 19 A054UZ 26
PSDPRT  M         A054DM  9 A054DR  7 A054ER  9 A054EZ  7 A054FM  7 A054FR  7 A054FZ  7 A054GM  7 A054GR  7 A054GZ  7
                  A054HC  9 A054HH  7 A054HM  7 A054HR  7 A054HW  7 A054IH  7 A054IM  7 A054IR  9 A054IW  7 A054JC  7
                  A054KR  9 A054LR  7 A054LW  9 A054LZ  7 A054MH  7 A054MM  7 A054NH  9 A054NM  9 A054NR  7 A054NW  7
                  A054NZ  7 A054OC  7 A054OR  7 A054PC  9 A054PH  7 A054QM  7 A054QR  9 A054RM  7 A054RR  9 A054RW  7
                  A054RZ  9 A054SC  8 A054SH  7 A054SM  7 A054SR  9 A054SW  7 A054TH  8 A054TM  8 A054TR  9 A054UC  9
                  A054UH  9 A054UM  7 A054UR  7 A054UZ  9 A054VH  9 A054VM 10 A054VW  7 A054VZ  7
PSLASP  M         A054DC  1 A054EH  1 A054EM  1 A054EN  1 A054EO  1 A054EW  1 A054FC  1 A054FH  1 A054FW  1 A054HX  1
                  A054IC  1 A054IX  1 A054IZ  1 A054JH  1 A054JM  1 A054JR  1 A054JW  1 A054JZ  1 A054KC  1 A054KH  1
                  A054KM  1 A054KW  1 A054KZ  1 A054LC  1 A054LH  1 A054LM  1 A054MA  1 A054MC  1 A054NS  1 A054NT  1
                  A054NU  1 A054NV  1 A054NX  1 A054OA  1 A054OH  1 A054OZ  1 A054PA  1 A054PB  1 A054PD  1 A054PE  1
                  A054PR  1 A054QI  1 A054QW  1 A1X1A   1 A1X1B   1 A1X1C   1 A1X1D   1 A1X2F   1 A1X3C   1 A1X4B   1
                  A1X4C   1 A3X2A   1 A54ND1  1 INTRO   1
PSNUMB  M         ###### 24
PSSPAZ  M         A054DM  4 A054DR  2 A054ER  4 A054EZ  2 A054FM  2 A054FR  2 A054FZ  2 A054GM  2 A054GR  2 A054GZ  2
                  A054HC  4 A054HH  2 A054HM  2 A054HR  2 A054HW  2 A054IH  2 A054IM  2 A054IR  4 A054IW  2 A054JC  2
                  A054KR  4 A054LR  2 A054LW  4 A054LZ  2 A054MH  2 A054MM  2 A054NH  4 A054NM  4 A054NR  2 A054NW  2
                  A054NZ  2 A054OC  2 A054OR  2 A054PC  4 A054PH  2 A054QM  2 A054QR  4 A054RM  2 A054RR  4 A054RW  2
                  A054RZ  4 A054SC  2 A054SH  2 A054SM  2 A054SR  4 A054SW  2 A054TH  2 A054TM  2 A054TR  4 A054UC  4
                  A054UH  4 A054UM  2 A054UR  2 A054UZ  4 A054VH  4 A054VM  4 A054VW  2 A054VZ  2 A1X3B   2 11PR01  4
RRO     R         ######  9 ###### 10
S1      S         A054DC  9 A054DM  2 A054DR 12 A054DZ  1 A054DZ  6 A054ER  2 A054HC  2 A054IR  2 A054JW 12 A054JW 32
                  A054JW 35 A054KM 12 A054KM 32 A054KM 35 A054KR  2 A054LW  2 A054MM 14 A054NM  2 A054NW  2 A054PC  2
                  A054PM  8 A054QM  9 A054QR  2 A054RR  2 A054RZ  2 A054SR  2 A054TR  2 A054UC  2 A054UM  2 A054UZ  2
                  A054VH  2 A054VM  2 INTRO   7 ON     13 ON     15 11PR01  2
S31     S         ###### 27 ###### 28 ##ON##  2 A054DC 10 A054DM  3 A054ER  3 A054HC  3 A054IR  3 A054KR  3 A054LW  3
                  A054MH  3 A054MM  3 A054PC  3 A054PM  9 A054QM 10 A054QR  3 A054RR  3 A054RZ  3 A054SR  3 A054TR  3
                  A054UC  3 A054UM  3 A054UZ  3 A054VH  3 A054VM  3 INTRO   9 11PR01  3
```

Fig. 6. Cross-reference table illustrating which audio, buffers, counters, functions, film images, labels, macros, return registers, switches, and counters used as switches have been used and where they have been used.

APPENDIX G

Clearfield Performance Records and Course Data

Table 1

Performance Records
Interactions from Clearfield

Segment No.	Possible Interactions	Total Number Of Attempts	Mean Number Of Attempts		Average Completion Time (in hours)
3	3	206	1.08	3.24	1.2
30	34	4066	1.43	48.62	.6
33	5	574	1.26	6.30	.4
10	31	3877	1.40	43.40	1.1
20	7	833	1.11	7.77	.4
40	55	7111	1.22	67.10	1.0
42	16	2039	1.24	19.84	.6
46	31	3737	1.20	37.20	1.0
52	38	4117	1.25	47.50	1.5
53	40	4527	1.22	48.80	.2
60	28	3304	1.47	41.16	1.6
61	11	2076	2.25	24.75	.2
62	3	248	1.02	3.06	.0
63	21	1239	1.04	21.84	.1
64	46	202	1.04	47.84	.2
65	20	1728	1.18	23.60	.5
70	3	223	1.09	3.27	.1
71	21	1718	1.25	26.25	1.7
80	35	2405	1.09	38.15	.9
81	25	2099	1.46	36.50	.1
92	27	1743	1.21	32.67	1.3
6	9	599	1.25	11.25	.2
4	65	4886	1.65	107.25	2.0
5	59	3220	1.63	96.17	2.1
7	36	1796	1.19	42.84	.1
11	65	3552	1.22	79.30	.3
12	41	3004	1.23	50.43	1.3
41	50	4356	1.45	72.50	2.1
23	42	2904	1.13	47.46	5
24	40	3216	1.23	49.20	1.4
96	17	1253	1.24	21.08	.5
100	44	2231	1.66	73.04	.5
101	43	2039	1.16	49.88	.5
102	75	4590	1.24	93.00	.5
105 Summary:	No Interaction				.1
120 EXAM					1.0
127 Sign-Off Transfer					
Totals	1086	85718		1422.26	27.8
Means	31.94	2521.12		41.83	

Table 2

Summary of Coursewriter Statements
by Segment - Clearfield Data

Segment Number	Number of Statements
0	2869
3	1120
30	2947
33	731
10	2746
20	1083
40	4833
42	1468
46	2636
52	3003
53	2912
60	2147
61	900
62	438
63	1984
64	2542
65	2285
70	756
71	3286
80	3671
81	2852
92	2297
6	813
4	2721
5	3342
7	3954
11	4431
12	3607
41	3689
23	2675
24	2352
96	1815
100	2735
101	2538
102	4576
105 (no interaction)	342
120 EXAM	6237
127 Sign-Off	
Total	95,375

Table 3

Numbers of Labels, Audio Messages, and Images by Segment - Clearfield Data

Segment Number	Number of Labels	Number of Audio Messages	Number of Images
0	36	11	12 = 12
3	42	7	13 + 1 = 14
30	103	14	28 + 5 = 33
33	19	7	1 + 1 = 2
10	99	0	19 + 4 = 23
20	35	7	8 + 10 = 18
40	146	24	25 + 11 = 36
42	42	21	14 + 2 = 16
46	80	26	6 + 1 = 7
52	83	9	18 + 2 = 20
53	92	17	8 + 3 = 11
60	105	9	17 + 6 = 23
61	47	4	6 = 6
62	16	4	5 + 3 = 8
63	57	1	6 + 1 = 7
64	105	8	18 + 4 = 24
65	79	9	29 + 3 = 32
70	31	1	3 = 3
71	123	21	7 + 5 = 12
80	138	8	15 + 1 = 16
81	115	7	0 = 0
92	74	22	26 + 3 = 29
6	27	1	5 + 1 = 6
4	83	4	9 + 4 = 13
5	95	6	10 + 2 = 12
7	104	79	13 + 3 = 16
11	231	0	37 + 3 = 40
12	91	13	18 + 3 = 21
41	83	25	24 + 4 = 28
23	74	31	1 = 1
24	53	26	0 = 0
96	49	28	3 = 3
100	96	7	5 + 5 = 10
101	79	1	2 + 6 = 8
102	140	1	1 + 4 = 5
105	13	0	0 = 0
120	80	0	0 = 0
127	2	0	0 = 0
Totals	2965	456	412 +103 = 515

APPENDIX H

Reactions of Site Visit Team

Report of Bureau of Educational Personnel Development Site Visit Team

Reactions to CARE 1

The following paragraphs are taken verbatim from the report of a Bureau of Educational Personnel Development Site Visit Team. The paragraphs most relevant to this report are included here; other paragraphs dealt primarily with administrative issues and budget matters.

To what extent does the project have a clear and substantive scholarly base?

> *Obviously builds on a vast store of technological and psychological know-how. The staff is well versed in areas directly related to the content of the CAI program.*

Has the project benefited from the active involvement of scholars of the host institution and elsewhere? If so, describe.

> *There is considerable evidence of wide involvement from the following groups: CAI Laboratory staff, Special Education staff of the Continuing Education Division of Penn State. Various contacts and collaborative efforts have been established with C. E. C. Convention staff, Special Education Department at Pitt, CAI Laboratory at University of Texas, and the staff of various federal agencies. All contacts have resulted in specific working relationships in development and dissemination activities.*

General comments and impressions of the Site Team on cirriculum:

> *This is an outstanding prototype project which maintains a carefully conceived training sequence uniquely applicable to the populations served. The curriculum content, essentially developed under a separate grant from B. E. H., is excellent and should be distributed widely to teacher education programs.*

General comments and impressions of site visitors on instructional resources:

> *The instructional resources for this project are clearly excellent. They reflect careful planning and integration of the component facets of the total project. There is, however, a clear need for the development of additional software components. It is our understanding that a second program on remediation techniques for the regular class teacher is being proposed. The team encourages the development of such an instructional program. It would be of further value to encourage the project staff to develop a master plan or model for the development of future software packages compatible with the system they have developed.*

General comments and impressions of site visitors on the present and potential outcome of the project:

The project is currently meeting its objectives of offering a CAI course to elementary school teachers in rural areas of the state. Approximately 700 teachers in the state will have completed the course as a result of project efforts.

The potential outcomes are limited only by a) demonstrated cost/effectiveness of the course, b) availability of additional software packages, c) future financial support for software development, evaluation, dissemination-adoption activities.

General comments of the Site Visit Team:

This is an outstanding example of how significant contributions to the field may be accomplished. The software program (CARE course) was developed by a group of Special Educators under B. E. H. contract support. Once developed, the E. P. D. A. project was proposed as a means for utilizing and delivering the course to teacher trainees. It appears that the logical next step is to obtain a comprehensive analysis of the effects of the course on teacher behavior, a detailed cost/effectiveness and evaluation in conjunction with a plan for dissemination and adoption of the project, and a comprehensive plan for development of future software programs in Special Education.

APPENDIX I

Comments from CEC Convention

Comments from CEC Convention
Miami Beach, Florida
April 19-23, 1971

It was a very good learning experience. The machine worked at my speed. I enjoyed using it.

Appears to have potential for concentrated inservice training of teachers where time is a factor.

How about underlining technical terms when introduced? or (TT)?

I am really impressed with this instructional technique. I can see the value of its use in a county such as mine; that is, a small rural one removed from a university setting. The inservice value would be great.

Feedback for answer was not appropriate. Should be revised.

I like the idea of immediate reward.

I have attempted to illustrate this concept to my classes. This approach seems to be a most effective way of illustrating this most basic tenet of special education.

I didn't spell appetite correctly and it didn't accept it.

What a fantastic machine. I tried to fool it several times or at least to confuse it but I failed. I think the positive comments that are in the answer checks are good for reinforcing the person taking the course. I felt that the machine was friendly because of the personal tone of the comments.

Previous question should have considered the term eyes.

I feel the need for human interaction with people when I learn about emotionally disturbed children. I learned some things and I believe that the system is excellent . . . thanks for the demo.

I find the light source hard on the eyes and after a time my eyes start to jump. As for the information that one is supposed to be acquiring, it is not reinforced soon enough in time or sequence.

I think this is a fantastic program not only for the teacher but almost as important for the layman who has had no experience with this problem. It helps him become a little more aware.

Wish there was a way to speed it up. Felt my attention lagging.

This is the most impressive thing I've seen at a convention.

Number 3 not enough information to make a decision.

I think that the program is very good and has great possibilities in underprivileged areas where students cannot afford to attend regular classes. I hope to see it spreading all over the nation soon.

I don't think that's a fair question. Which developmental period is referred to: during pregnancy? environmental?

I think this is a well organized course for teachers. It is a most unique way of presenting material to the teacher of children with learning problems.

Very impressed by the concept. Also was very happy that the tests FGST, DDST, and MRT were explained to teachers. I feel this is one area that teachers need more information--test interpretation.

It has not been proven to any satisfactory results that the answer given to this particular question is true. In fact it has been found that retardation or a retarded child can come from any type of background due to the many factors involved, e.g., brain damage.

1. sound and word pictures should be kept identical and together
2. very excellent idea and should be used in the teachers colleges to aid in educational instruction

This program should be available to all training programs in the vision program.

Keywording does not detect first letter missing. That's quite the thing though.

The chapter seemed quite complete for an introductory deaf education and certainly brought to light several important facts that all teachers should be aware of. The van is amazing and found it extremely enjoyable.

I would be very interested in more information concerning your computer program and how adaptable it would be for a classroom situation. This is my first experience with a computer program and I enjoyed it very much. It is fantastic for instant reinforcement and individualized instruction--too bad it costs so much. Thank you.

APPENDIX J

Student Opinion Survey and Statistical Summary of SOS Statements from Four Sites, with Representative Comments

In order to help the reader of this report better understand the SOS scores, the Student Opinion Survey has been divided into individual statements. Following each statement is a chart containing a summary of the students' responses from each location. The percentage of students who rated the statement at each point along the 8 point scale is given.

Below each chart are representative comments from the students at the various locations. The comments may help to explain the ratings in the chart.

STUDENT OPINION TOWARD COMPUTER-ASSISTED INSTRUCTION

1. The method by which I was told whether I had given a right or wrong answer became monotonous.

   Strongly Disagree   Disagree   Uncertain   Agree   Strongly Agree

2. Nobody really cared whether I learned the course material or not.

   Strongly Disagree   Disagree   Uncertain   Agree   Strongly Agree

3. I felt challenged to do my best work.

   Strongly Disagree   Disagree   Uncertain   Agree   Strongly Agree

4. I felt isolated and alone.

   All the time   Most of the time   Some of the time   Very Seldom   Never

5. I felt as if someone were engaged in conversation with me.

   All the time   Most of the time   Some of the time   Very Seldom   Never

6. As a result of having studied by this method, I am interested in learning more about the subject matter.

   Strongly Disagree   Disagree   Uncertain   Agree   Strongly Agree

7. I was more involved in operating the terminal than in understanding the course material.

   All the time   Most of the time   Some of the time   Very Seldom   Never

8. The learning was too mechanical.

   Strongly Disagree   Disagree   Uncertain   Agree   Strongly Agree

9. I felt as if I had a private tutor.

   Strongly Disagree   Disagree   Uncertain   Agree   Strongly Agree

10. The equipment made it difficult to concentrate on the course material.

All the time	Most of the time	Some of the time	Very Seldom	Never

11. The situation made me quite tense.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

12. Computer-assisted instruction, as used in this course, is an inefficient use of the student's time.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

13. My feeling toward the course material after I had completed the course was favorable.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

14. I felt frustrated by the situation.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

15. I found the computer-assisted instruction approach in this course to be inflexible.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

16. Material which is otherwise interesting can be boring when presented by CAI.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

17. I was satisfied with what I learned while taking the course.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

18. In view of the amount I learned, this method seems superior to classroom instruction for many courses.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

19. I would prefer computer-assisted instruction to traditional instruction.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

20. Computer-assisted instruction is just another step toward de-personalized instruction.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

21. I was concerned that I might not be understanding the material.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

22. The responses to my answers seemed appropriate.

All the time	Most of the time	Some of the time	Very Seldom	Never

23. I felt uncertain as to my performance in the programed course relative to the performance of others.

All the time	Most of the time	Some of the time	Very Seldom	Never

24. I was not concerned when I missed a question because nobody was watching me.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

25. I found myself trying to get through the material rather than trying to learn.

All the time	Most of the time	Some of the time	Very Seldom	Never

26. I knew whether my answer was right or wrong before I was told.

All the time	Most of the time	Some of the time	Very Seldom	Never

27. In a situation where I am trying to learn something, it is important to me to know where I stand relative to others.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

28. I guessed at the answers to some questions.

All the time	Most of the time	Some of the time	Very Seldom	Never

29. I was aware of efforts to suit the material specifically to me.

All the time	Most of the time	Some of the time	Very Seldom	Never

30. I was encouraged by the responses given to my answers to questions.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

31. In view of the time allowed for learning, I felt too much material was presented.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

32. I entered wrong answers in order to get more information from the machine.

All the time	Most of the time	Some of the time	Very Seldom	Never

33. I felt I could work at my own pace.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

34. Questions were asked which I felt were not related to the material presented.

All the time	Most of the time	Some of the time	Very Seldom	Never

35. I was aware of the flickering screen while I was taking the course.

All the time	Most of the time	Some of the time	Very Seldom	Never

36. Material which is otherwise boring can be interesting when presented by CAI.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

37. I could have learned more if I hadn't felt pushed.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

38. I was given answers but still did not understand the questions.

All the time	Most of the time	Some of the time	Very Seldom	Never

39. The course material was presented too slowly.

All the time	Most of the time	Some of the time	Very Seldom	Never

40. The responses to my answers seemed to take into account the difficulty of the question.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

41. While on computer-assisted instruction, I encountered mechanical malfunctions.

All the time	Most of the time	Some of the time	Very Seldom	Never

42. Computer-assisted instruction did not make it possible for me to learn quickly.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

1. The method by which I was told whether I had given a right or wrong answer became monotonous.

Location	Frequency in Percentage							
Clearfield (N=90)	36.67	21.11	8.89	8.89	4.44	7.78	5.56	6.67
Ridgway (N=118)	44.07	20.34	11.86	4.24	3.39	7.63	4.24	4.24
Penn State (N=27)	40.74	14.81	11.11	3.70	7.41	7.41	14.81	0.00
Smethport (N=108)	50.00	20.37	6.48	4.63	3.70	7.41	2.78	4.63
	Strongly Disagree							Strongly Agree
	8	7	6	5	4	3	2	1

Clearfield	Although it was somewhat monotonous it was beneficial in most cases because it helped me to use the proper terminology which I believe is essential to the material of the course.
Ridgway	I expected to see my first name used more often. When using the light pen the right answers would not always enter.
Penn State	I thought it was a very motivating method, including an explanation of why I was right or wrong. This method helped me to learn more about what I was studying and it increased my understanding.
Smethport	The feedback was very helpful. It gave good reasoning. I felt the immediate reinforcement greatly enhanced the understanding of the concepts in the course.

2. Nobody really cared whether I learned the course material or not.

Location	Frequency in Percentage							
Clearfield (N=90)	56.67	7.78	5.56	10.00	2.22	7.78	2.22	7.78
Ridgway (N=118)	44.07	20.34	11.86	4.24	3.39	7.63	4.24	4.24
Penn State (N=27)	70.37	18.52	11.11	0.00	0.00	0.00	0.00	0.00
Smethport (N=108)	39.81	19.44	9.26	8.33	.93	4.63	4.63	12.96
	Strongly Disagree							Strongly Agree
	8	7	6	5	4	3	2	1

Clearfield	Seemingly the computer did not care if you learned or not. But the fact that people took the time to work out this system of study and are continually trying to improve the course leads one to think somewhat the opposite.
Ridgway	I got out of the course what I put into it. I cared.
Penn State	The enthusiasm of the staff was very influential in maintaining my interest. Seeing my name used occasionally made the course more personalized and enjoyable.
Smethport	It need not be important to anyone else but for my own information. Personal motivation is a sure sign of maturity. I cared.

3. I felt challenged to do my best work.

Location	Frequency in Percentage							
Clearfield (N=90)	16.67	4.44	5.56	5.56	4.44	16.67	14.44	32.22
Ridgway (N=118)	11.02	0.00	5.93	10.17	5.93	16.95	16.95	33.05
Penn State (N=27)	11.11	3.70	3.70	3.70	3.70	25.93	18.52	26.63
Smethport (N=108)	1.85	2.78	5.56	6.48	10.19	18.52	22.22	32.41
	Strongly Disagree 1	2	3	4	5	6	7	Strongly Agree 8

Clearfield	I did at times, but sometimes the material was not interesting enough to warrant my best efforts. I found myself not really listening, for example, to the audio messages.
Ridgway	You are working at your own speed and at your own level. This for me was an incentive to do my best.
Penn State	I felt I had to keep up in order to answer the questions and understand the material. This is the first course I have taken in six terms in which I had my reading done before I began studying a particular section.
Smethport	There was little time and thus did not feel I had the time to study between classes. I did not feel like I was competing against anyone but myself.

4. I felt isolated and alone.

Location	Frequency in Percentage							
Clearfield (N=90)	4.44	1.11	1.11	5.56	7.78	13.33	10.00	56.67
Ridgway (N=118)	.85	1.69	2.54	5.08	3.39	11.02	12.71	62.71
Penn State (N=27)	0.00	0.00	7.41	7.41	7.41	11.11	18.52	48.15
Smethport (N=108)	0.00	2.78	3.70	7.41	6.48	8.33	11.11	60.19
	All the Time 1	2	3	4	5	6	7	Never 8

Clearfield	The proctors were very willing to help unmuddle any messes I created with your circuits.
Ridgway	I felt the computer was alive. There was a friendly atmosphere here. There were always new people to meet at the class and the proctors and men in charge were very friendly.
Penn State	I was frustrated by the absence of opportunity to discuss a point or a wrong answer. To me the computer represented not just one teacher nor being alone but a whole team of people who really cared.
Smethport	The proctors were always ready and willing to help whenever needed.

5. I felt as if someone were engaged in conversation with me.

Location	Frequency in Percentage							
Clearfield (N=90)	22.22	17.78	15.56	12.22	12.22	5.56	5.56	8.89
Ridgway (N=118)	22.03	18.64	18.64	11.86	7.63	5.93	4.24	11.02
Penn State (N=27)	18.52	11.11	29.63	7.41	7.41	7.41	7.41	11.11
Smethport (N=108)	30.56	24.07	13.89	15.74	3.70	4.63	1.85	5.56
	All the Time							Never
	8	7	6	5	4	3	2	1

Clearfield	The conversation was one-sided. I think that a change in voices on the audio messages would be good.
Ridgway	At times the computer seemed to have a personality. Some of the taping really seemed like a dialogue. Thank you for the humor that you used in programing the material. It made me feel as though you people really cared about us.
Penn State	At times I didn't understand and would have liked further answers and responses to questions. I felt like it was more a conversation with myself.
Smethport	Computer use of names seemed personal. Warm and friendly atmosphere. I liked this feeling. I have begun to think there is a little man sitting inside this CRT. Weird, huh?

6. As a result of having studied by this method, I am interested in learning more about the subject matter.

Location	Frequency in Percentage							
Clearfield (N=90)	7.78	2.22	3.33	5.56	5.56	15.56	18.89	41.77
Ridgway (N=118)	6.78	5.08	5.08	9.32	4.24	16.95	18.64	33.90
Penn State (N=27)	0.00	7.41	3.70	7.41	7.41	7.41	29.63	37.04
Smethport (N=108)	4.63	2.78	1.85	5.56	9.26	19.44	10.19	46.30
	Strongly Disagree 1	2	3	4	5	6	7	Strongly Agree 8

Clearfield	I hope that additional courses in the CARE package will be offered. I am interested in the subject matter no matter how it is presented however, I would definitely sign on (pun) again.
Ridgway	Would be more interested in similar course more strongly aimed at the secondary teacher. When does CARE 2 begin? I got very tired and my eyes were very sore. As a result I would never register for another course of this type.
Penn State	I am interested in learning more about the field but I feel this is more due to my interests in the field.
Smethport	I would like to delve into each of the topics a bit more in detail. It has been a very helpful course for me and someday I would like to continue. Yes, as I teach a slow group. A follow up course in remedial techniques would be ideal.

7. I was more involved in operating the terminal than in understanding the course material.

Location	Frequency in Percentage							
Clearfield (N=90)	4.44	2.22	6.67	2.22	5.56	14.44	18.89	45.56
Ridgway (N=118)	0.00	1.69	3.39	6.78	3.39	15.25	22.03	47.46
Penn State (N=27)	0.00	0.00	3.70	0.00	0.00	7.41	29.63	59.26
Smethport (N=108)	0.00	2.78	3.70	3.70	5.56	9.26	19.44	55.56
	All the Time------- 1	2	3	4	5	6	7	-------Never 8

Clearfield	During the first few sessions, the mechanics got in the way of the material. However, after that I enjoyed the machine.
Ridgway	On several occasions where numbers were used I made the number 1 with the small letter L. It was difficult to concentrate on the course material when the machine did not operate properly. Once you become completely familiar with the unit you can become totally involved with the course material.
Penn State	I must admit--the machine was fun. The operation of the terminal wax explained well the first session. Working the machine is fairly easy.
Smethport	Terminal is easy to operate. Enjoyed using the terminal. It did not bother me at all. The handicap of not typing bothered me.

8. The learning was too mechanical.

Location	Frequency in Percentage							
Clearfield (N=90)	30.00	16.67	10.00	7.78	5.56	7.78	8.89	13.33
Ridgway (N=118)	43.22	16.95	11.02	4.24	6.78	7.63	5.08	5.08
Penn State (N=27)	29.63	14.81	3.70	7.41	3.70	22.22	18.52	0.00
Smethport (N=108)	46.30	17.59	11.11	7.41	4.63	8.33	2.78	1.85
	Strongly Disagree							Strongly Agree
	8	7	6	5	4	3	2	1

Clearfield	I prefer the human element. It afforded little chance for questioning such as would be available in the classroom.
Ridgway	More quizzes and surprises would have been welcome. Individualized instruction of this nature cannot be too mechanical. The content was more important than the type of instruction.
Penn State	I think some type of discussion to supplement the course would make it more effective. It got monotonous sometimes.
Smethport	I enjoyed the opportunity to work at my own speed. It fascinated me. After all IBM 1510 is a machine.

9. I felt as if I had a private tutor.

Location	Frequency in Percentage							
Clearfield (N=90)	8.89	6.67	8.89	12.22	5.56	21.11	12.22	24.44
Ridgway (N=118)	11.02	2.54	4.24	8.47	8.47	16.95	15.25	33.05
Penn State (N=27)	3.70	7.41	3.70	14.81	7.41	14.81	33.33	14.81
Smethport (N=108)	5.56	3.70	3.70	4.63	4.63	12.96	22.22	42.59
	Strongly Disagree 1	2	3	4	5	6	7	Strongly Agree 8

Clearfield	You can't ask questions and need exact answers sometimes. Sometimes I didn't know what was wrong with the answer I had.
Ridgway	I liked the way mistakes were handled, not going on until you understood the concept.
Penn State	After two years of PSU's mass education it was a joy to get some individual attention. Most of the time this was the feeling I had but at times, such as when I had a question concerning the material I felt the need of being instructed by a human.
Smethport	I enjoyed the one-to-one basis with the absence of extraneous material from either professor or other students. If I had a tutor I could have asked a question to clarify a point. The feedback was encouraging. I could go as fast as I wanted.

10. The equipment made it difficult to concentrate on the course material.

Location	Frequency in Percentage							
Clearfield (N=90)	7.78	5.56	2.22	3.33	8.89	13.33	18.89	40.00
Ridgway (N=118)	2.54	6.78	2.54	6.78	8.47	9.32	19.49	44.07
Penn State (N=27)	0.00	0.00	0.00	0.00	7.41	11.11	18.52	62.96
Smethport (N=108)	.93	.93	5.56	10.19	7.41	17.59	20.37	37.04
	All the Time							Never
	1	2	3	4	5	6	7	8

Clearfield	Several sets of earphones could not be adjusted to a comfortable position and I had a headache from them. Also when the earphones came from the right side I had quite a time turning the pages of my notebook.
Ridgway	The equipment, noise and the cold air sometimes caused discomfort. I felt it difficult to concentrate when some of the proctors stood around and would talk. This became very difficult to concentrate on your material.
Penn State	The equipment was easy to manage and it only facilitated my learning.
Smethport	The only difficulty was the air conditioning, but understand that was necessary. The noise of the air conditioning unit made it hard to concentrate. Sometimes the machines malfunctioned.

11. The situation made me quite tense.

Location	Frequency in Percentage							
Clearfield (N=90)	48.89	13.33	7.78	5.56	7.78	4.44	3.33	8.89
Ridgway (N=118)	53.39	16.10	7.63	6.78	5.08	3.39	4.24	3.39
Penn State (N=27)	70.37	14.81	11.11	0.00	3.70	0.00	0.00	0.00
Smethport (N=108)	50.26	12.96	6.48	3.70	2.78	6.48	.93	7.41
	Strongly Disagree							Strongly Agree
	8	7	6	5	4	3	2	1

Clearfield	For the first few times. Only because I felt rushed to finish.
Ridgway	There was nothing tense about the situation. It was the least tense situation I have experienced on the college level. I felt tense in trying to finish in the six week period alloted.
Penn State	I felt very relaxed at all times--mostly because I could progress at my own speed.
Smethport	When we found out the course would be one week shorter than it was intended it was a chore to finish and as a result didn't do the best work. I always felt at ease when working. I never had time fly by so rapidly. I felt very relaxed.

12. Computer-assisted instruction, as used in this course, is an efficient use of the student's time.

Location	Frequency in Percentage							
Clearfield (N=90)	57.78	8.89	7.78	3.33	1.11	7.78	7.78	5.56
Ridgway (N=118)	62.71	15.25	3.39	3.39	2.54	2.54	1.69	8.47
Penn State (N=27)	59.26	11.11	7.41	0.00	3.70	3.70	3.70	11.11
Smethport (N=108)	71.30	9.26	1.85	.93	2.78	.93	4.63	8.33
	Strongly Disagree							Strongly Agree
	8	7	6	5	4	3	2	1

Clearfield	Some method of eliminating materials that one already knows might be devised. Also, I felt that more time might have been devoted to actual case studies. It beats sitting in most classrooms I've been in.
Ridgway	I feel it does not waste your time with long discussions. I feel that this course was very efficient.
Penn State	The important thing is to stay alert while using the machine and absorb each frame. Too much time is wasted in regular classes when a student goes to class even if he won't get anything from that particular lecture. This system lets the student learn, recite, and get feedback all at the same time.
Smethport	I feel that this type of instruction leads to much greater retention. It was highly efficient. It is terribly efficient . . . you work at your own pace and don't have to wait until some windbag gets finished before you can go on to meaningful material.

13. My feeling toward the course material after I had completed the course was favorable.

Location	Frequency in Percentage							
Clearfield (N=90)	5.56	3.33	0.00	1.11	4.44	11.11	17.78	56.67
Ridgway (N=118)	0.85	4.24	0.00	2.54	2.54	11.02	23.73	55.07
Penn State (N-27)	0.00	0.00	0.00	0.00	0.00	18.52	18.52	62.96
Smethport (N=108)	6.48	0.00	.93	2.78	2.78	9.26	17.59	60.19
	Strongly Disagree							Strongly Agree
	1	2	3	4	5	6	7	8

Clearfield	The course content was excellent. Everything seemed to be tied together in the end. . . . the first five chapters were a bore.
Ridgway	The course presented more real examples and applications than is usual in a course of this type. I enjoyed the course very much I would have liked . . . more on the secondary level.
Penn State	I feel that I learned the concepts very well and that I can apply them to many other situations in which I will be dealing with people (basing assumptions on more than 1 or 2 observations, being objective in reporting data, etc.).
Smethport	The course made me more aware of problems that occur in the school setting. I feel it will help me understand many of the problems that could be in my classroom that I was not aware of.

14. I felt frustrated by the situation.

Location	Frequency in Percentage							
Clearfield (N=90)	11.11	4.44	8.89	7.78	5.56	5.56	11.11	45.56
Ridgway (N=118)	1.69	1.69	6.78	8.47	8.47	10.17	13.56	49.15
Penn State (N=27)	3.70	0.00	18.52	0.00	3.70	11.11	14.81	48.15
Smethport (N=108)	4.63	1.85	11.11	2.78	6.48	4.63	13.89	54.63
	Strongly Disagree 8	7	6	5	4	3	2	Strongly Agree 1

Clearfield	Yes, some night after your computer broke down about two or three times you felt very frustrated. Only the problems in scheduling were a frustration.
Ridgway	On some occasions I felt I had answered correctly but the computer would not accept my reasoning. Frustrated only when I couldn't go back and review. I felt no frustration at any time.
Penn State	I felt very good about the situation, as a matter of fact, I looked forward to coming to class. I felt frustrated a few times when I felt that my answer was correct but was not received by the computer as a correct response.
Smethport	I felt I had to hurry. Only when the machines didn't work. If anything this course stimulated me to attend as often as time permitted.

15. I found the computer-assisted instruction approach in this course to be inflexible.

Location	Frequency in Percentage							
Clearfield (N=90)	18.89	14.44	12.22	11.11	10.00	10.00	6.67	16.67
Ridgway (N=118)	27.12	12.71	11.02	10.17	7.63	11.86	8.47	11.02
Penn State (N=27)	33.33	7.41	7.41	7.41	0.00	25.93	7.41	11.11
Smethport (N=108)	36.11	13.89	12.04	8.33	9.26	4.63	9.26	6.48
	Strongly Disagree							Strongly Agree
	8	7	6	5	4	3	2	1

Clearfield	It was inflexible to the extent that any time I disagreed or did not understand, there was no real opportunity for discussion of the problem. The human understanding was not there.
Ridgway	I wished I could clarify my viewpoint. Only with regard to scheduling. I would have liked to ask questions and was unable to do so. All I was able to do was comment on the questions asked.
Penn State	It was inflexible in that it often did not respond to my weaknesses and review more often. Possible such a presentation is somehwat inflexible, but the idea hadn't occurred to me until the question was asked. Flexibility does not seem particularly important in this case.
Smethport	Only inflexible in the way that it accepted answers. It gave no opportunity for discussion type situations. One thing that should be improved is to have a method of reviewing certain chapters at all times and not whenever you are asked by the computer.

16. Material which is otherwise interesting can be boring when presented by CAI.

Location	Frequency in Percentage							
Clearfield (N=90)	47.78	14.44	11.11	3.33	2.22	2.22	5.56	13.33
Ridgway (N=118)	51.69	15.25	8.47	7.63	5.93	2.54	3.39	5.08
Penn State (N-27)	29.63	18.52	14.81	7.41	3.70	22.22	0.00	3.70
Smethport (N=108)	66.67	19.44	4.63	1.85	0.93	2.78	1.85	1.85
	Strongly Disagree 8	7	6	5	4	3	2	Strongly Agree 1

Clearfield	More examples should be given to color the course material.
Ridgway	It's not boring, however, sitting still for a relatively long period of time reduces concentration and lessens interest. It was more interesting because of the novel method of presentation.
Penn State	I feel discussion would have accented the material making it a little more interesting.
Smethport	This material was extremely more interesting than regular classroom activities. I would like very much to take many classes by computer. I hope we have more opportunity to take more courses.

17. I was satisfied with what I learned while taking the course.

Location	Frequency in Percentage							
Clearfield (N=90)	8.89	2.22	1.11	4.44	2.22	14.44	23.33	43.33
Ridgway (N=118)	5.08	0.00	4.24	.85	3.39	8.47	24.58	53.39
Penn State (N=27)	0.00	3.70	3.70	3.70	0.00	18.52	37.04	33.33
Smethport (N=108)	2.78	0.93	0.93	4.63	0.93	9.26	21.30	59.26
	Strongly Disagree							Strongly Agree
	1	2	3	4	5	6	7	8

Clearfield	More time could have been spent on remedies. I feel the course was excellent.
Ridgway	Now if I could put it to use I will be even more satisfied. I was hoping there would be more stress on secondary (school) problems rather than so much concern with elementary level.
Penn State	For an introductory course in education of exceptional children, I definitely have ended this course with satisfaction concerning what I feel I have learned. I would have liked to ask some questions and have opportunities for discussion.
Smethport	As I said before, this has been the best set of learning circumstances I have been exposed to thus far. I was satisfied because I feel it will benefit me in my work. Practical.

18. In view of the amount I learned, this method seems superior to classroom instruction for many courses.

Location	Frequency in Percentage							
Clearfield (N=90)	20.00	7.78	1.11	14.44	11.11	12.22	13.33	20.00
Ridgway (N=118)	11.86	5.08	5.93	6.78	7.63	12.71	18.64	31.36
Penn State (N=27)	14.81	3.70	11.11	0.00	7.41	14.81	18.52	29.63
Smethport (N=108)	3.70	4.63	3.70	7.41	6.48	11.11	16.67	46.30
	Strongly Disagree 1	2	3	4	5	6	7	Strongly Agree 8

Clearfield	Depending on the course, of course. There is room for both types of instruction.
Ridgway	Can't take the place of a teacher. In the classroom you must go at the teacher's pace of instruction. The computer program lets you go at your own pace. I feel that the method of presentation must take into account the objectivity or subjectivity of the course material.
Penn State	This method can be useful especially for survey courses. For a few courses maybe, but not all and not necessarily this one. Most classroom instructors can be more boring and biased than any computer.
Smethport	I believe in letting someone learn at their own rate whenever possible. For an inservice teacher this has been the best method I have found. I am a person who likes to ask questions to the professor.

19. I would prefer computer-assisted instruction to traditional instruction.

Location	Frequency in Percentage							
Clearfield (N=90)	23.33	10.00	4.44	17.78	10.00	11.11	13.33	10.00
Ridgway (N=118)	11.02	10.17	5.08	21.19	8.47	12.71	10.17	21.19
Penn State (N=27)	11.11	11.11	11.11	3.70	14.81	25.93	14.81	7.41
Smethport (N=108)	6.48	5.56	8.33	16.67	12.04	12.04	9.26	29.63
	Strongly Disagree 1	2	3	4	5	6	7	Strongly Agree 8

Clearfield	Depends on the subject matter. I can go at my own rate, but lose the ideas and thinking of others.
Ridgway	Some questions arise that an instructor can often times give a better insight into the answer. I would prefer it only in certain classes.
Penn State	I enjoyed this course--it was a good change--but I don't think I would like to take all of by courses by computer. For certain courses it is excellent.
Smethport	Depending on the type of course. Not in an overall program but in some courses. Depends on the instructor and the class.

20. Computer-assisted instruction is just another step toward de-personalized instruction.

Location	Frequency in Percentage							
Clearfield (N=90)	33.33	10.00	14.44	7.78	10.00	6.67	8.89	8.89
Ridgway (N=118)	47.46	13.46	8.47	4.24	12.71	6.78	2.54	4.24
Penn State (N=27)	25.93	29.63	11.11	7.41	0.00	18.52	0.00	7.41
Smethport (N=108)	37.04	18.52	11.11	12.96	6.48	2.78	7.41	3.70
	Strongly Disagree------	------	------	------	------	------	------	Strongly Agree
	8	7	5	5	4	3	2	1

Clearfield	It's another way of teaching which may be a good approach for some learners. It's just as depersonalized in a class with 300 people and the prof never sees your face.
Ridgway	CAI definitely has its place in education I hope not. I value my job.
Penn State	I felt this was much more personalized than many of my classes. In many cases depersonalized instruction is not an undesirable approach.
Smethport	It will never replace man entirely I got a kick out of the machine calling me by my first name. If something is worth using, use it, even if it is somewhat depersonalized.

21. I was concerned that I might not be understanding the material.

Location	Frequency in Percentage							
Clearfield (N=90)	31.11	17.78	5.56	4.44	6.67	10.00	10.00	14.44
Ridgway (N=118)	33.05	20.34	9.32	10.17	5.93	8.47	6.78	5.93
Penn State (N=27)	44.44	7.41	11.11	11.11	0.00	14.81	7.41	3.70
Smethport (N=108)	31.48	16.67	12.04	8.33	3.70	12.04	6.48	9.26
	Strongly Disagree 8	7	6	5	4	3	2	Strongly Agree 1

Clearfield	Too much vocabulary for the layman. Only chapter 14.
Ridgway	I thought the computer might move too fast but it did not. Sometimes I was concerned. . . .someone cannot help but understand the information because there was a constant feedback and an opportunity to review if felt it was needed.
Penn State	With the immediate and constant feedback there was never a question. On some items that I didn't understand, there was no way for the computer to explain it any further to me.
Smethport	Everything was planned very well. This happens at infrequent intervals. I was quite comfortable in the fact that there would be the opportunity for review.

22. The responses to my answers seemed appropriate

Location	Frequency in Percentage							
Clearfield (N=90)	20.00	17.78	26.67	16.67	8.89	4.44	4.44	1.11
Ridgway (N=118)	16.10	28.21	24.58	17.80	6.78	4.24	1.69	0.00
Penn State (N=27)	14.81	29.63	40.74	11.11	0.00	3.70	0.00	0.00
Smethport (N=108)	21.30	25.00	34.26	6.48	7.41	4.63	0.93	0.00
	All the Time							Never
	8	7	6	5	4	3	2	1

Clearfield	I was most upset when I gave correct responses and was told I gave an incorrect response.
Ridgway	A couple of times I had had the correct answer and it was indicated as wrong, which although understandable in a course of this type, still upset me slightly. I especially enjoyed seeing my name used.
Penn State	Sometimes I would have liked to argue with the computer or felt that the questions were not worded clearly. At times I wished I could have had a more detailed response. Yes they did, however, there is no provision for justifying or qualifying.
Smethport	Sometimes I would have liked to give an argument. On some occasion my answers were adequate and the computer refused them.

23. I felt uncertain as to my performance in the programed course relative to the performance of others.

Location	Frequency in Percentage							
Clearfield (N=90)	23.33	10.00	8.89	14.44	6.67	7.78	12.22	16.67
Ridgway (N=118)	6.78	8.47	13.47	12.71	11.86	14.41	13.56	18.64
Penn State (N=27)	11.11	11.11	22.22	0.00	3.70	11.11	22.22	18.52
Smethport (N=108)	8.33	10.19	12.96	12.04	12.96	11.11	14.81	17.59
	All the Time 1	2	3	4	5	6	7	Never 8

Clearfield	No one ever talked about how he was doing. I wasn't too concerned with what others were learning.
Ridgway	I really didn't care how my performance ranked in relation to the performance of others. The only indication of your performance in relation to others was that they were either completing the course at a faster or slower rate than you were.
Penn State	I have no idea how the others are doing but I feel as though I have done well so the others don't really matter. Not uncertain, but curious . . . it's a difficult habit to break.
Smethport	I was not interested in the performance of others. I tried to do the best I could and not worry about the others. I am a teacher aide and felt very inadequate most of the time. Because of my situation, though, I feel I got more out of the course than most people taking it.

24. I was not concerned when I missed a question because nobody was watching me.

Location	Frequency in Percentages							
Clearfield (N=90)	16.67	8.89	7.78	4.44	2.22	10.00	15.56	34.44
Ridgway (N=118)	11.02	10.17	9.32	9.32	5.93	8.47	11.86	33.90
Penn State (N=27)	14.81	0.00	14.81	0.00	7.41	14.81	18.52	29.63
Smethport (N=108)	16.67	11.11	10.19	1.85	6.48	10.19	12.04	31.48
	Strongly Disagree							Strongly Agree
	1	2	3	4	5	6	7	8

Clearfield	This is true to some extent, of course no one wants to miss the question. Superbrain can harass you as much as any person.
Ridgway	I was concerned with missing an answer because I might be misinterpreting the information. I was not concerned when I missed a question because I was confident that the designers of the software were clever enough to provide prompt remediation. I felt it was going against my grade.
Penn State	I did not like goofing even if no one knew. I was disappointed in myself when I missed a question. I was fairly unconcerned but I did feel someone was watching me.
Smethport	Yes in a way. I knew the computer would know. It seems a natural instinct to be concerned when I did miss a question but then the course was a personal learning experience; therefore, the concern left shortly. I never get too "uptight" about others watching me.

25. I found myself trying to get through the material rather than trying to learn.

Location	Frequency in Percentages							
Clearfield (N=90)	7.78	3.33	12.22	6.67	11.11	15.56	15.56	27.78
Ridgway (N=118)	4.24	2.54	11.86	8.47	10.17	18.64	23.73	20.34
Penn State (N=27)	3.70	11.11	3.70	0.00	7.41	18.52	18.52	37.04
Smethport (N=108)	1.85	7.41	9.26	8.33	8.33	23.15	15.74	25.93
	All the Time							Never
	1	2	3	4	5	6	7	8

Clearfield	Outside pressures . . . time factor. I think this is because I had trouble arranging a schedule.
Ridgway	Bad weather and limited schedule times made me feel I might not be able to finish in time. I found myself doing this when I learned I did not have a great amount of time to finish the course.
Penn State	I dwelled upon things I was unsure of because time was of no importance. Towards the end of the course I did go a little quicker since I saw the end so near, but did not at the same time neglect the material.
Smethport	Some of the material did not seem to apply or was uninteresting. I hurried through this. The time limit was too short. I found I was learning for myself.

26. I knew whether my answer was right or wrong before I was told.

Location	Frequency in Percentages							
Clearfield (N=90)	5.56	4.44	10.00	15.56	18.89	25.56	14.44	5.56
Ridgway (N=118)	5.08	4.24	9.32	9.32	24.58	22.88	18.64	5.93
Penn State (N=27)	0.00	0.00	3.70	22.22	14.81	25.93	22.22	11.11
Smethport (N=108)	3.70	5.56	12.04	14.81	21.30	20.37	21.30	.93
	All the Time 1	2	3	4	5	6	7	Never 8

Clearfield	Usually this could be determined by the way the question was asked.
Ridgway	Sometimes I was not sure of the question. Sometimes I answered without really thinking. Sometimes my answers would parallel the computer's but it wouldn't recognize mine.
Penn State	I think that most of my wrong answers were due to the fact that I pushed the keys to enter before checking my answer. Found myself trying to second guess the computer sometimes by trying to answer the way I thought it was programed rather than the way I thought.
Smethport	Most of the time. Sometimes. Sometimes I got in a hurry.

27. In a situation where I am trying to learn something, it is important to me to know where I stand relative to others.

Location	Frequency in Percentages							
Clearfield (N=90)	32.22	10.00	11.11	7.78	6.67	10.00	11.11	11.11
Ridgway (N=118)	31.36	12.71	10.17	11.86	3.39	14.41	11.02	5.08
Penn State (N=27)	33.33	11.11	22.22	3.70	11.11	3.70	14.81	0.00
Smethport (N=108)	37.04	12.96	7.41	9.26	12.96	12.04	4.63	3.70
	Strongly Disagree 8	7	6	5	4	3	2	Strongly Agree 1

Clearfield	It gives some incentive to have an idea where you stand.
Ridgway	Since I was taking this course with friends, it seemed necessary to keep at least on the same chapter. I feel I am learning for myself and myself alone.
Penn State	I learn for myself. Unfortunately, in the educational system students compete with one another for top grades which contribute to anxiety.
Smethport	The CAI made up for that by showing me where I stood relative to myself. I think it helps keep me on my toes to know how well I am doing in relation to others.

28. I guessed at the answers to some questions.

Location	Frequency in Percentages							
Clearfield (N=90)	1.11	12.22	10.00	12.22	6.67	27.78	26.67	3.33
Ridgway (N=118)	.85	5.08	13.56	16.95	12.71	26.27	22.88	1.69
Penn State (N=27)	7.41	22.22	44.44	7.41	3.70	7.41	7.41	0.00
Smethport (N=108)	4.63	16.67	25.93	11.11	20.37	12.96	5.56	2.78
	All the Time							Never
	1	2	3	4	5	6	7	8

Clearfield	Sometimes it was necessary as I was stumped on certain situation. Some of the questions were not clearly stated.
Ridgway	Sometimes--Occasionally questions offered little hints to right answers. Sometimes you guessed at the answers especially when you were tired and everything was going wrong for you.
Penn State	I may have been unsure or misinterpreted the question but I feel as though the course gave enough material so that I didn't have to guess. (only comment)
Smethport	Occasionally. Some of the material was not related to my work and so I guessed.

29. I was aware of efforts to suit the material specifically to me.

Location	Frequency in Percentages							
Clearfield (N=90)	13.33	17.78	13.33	10.00	7.78	7.78	13.33	16.67
Ridgway (N=118)	11.86	22.88	16.10	15.25	9.32	15.25	6.78	2.54
Penn State (N=27)	11.11	7.41	29.63	11.11	7.41	18.52	3.70	11.11
Smethport (N=108)	15.74	25.93	13.89	14.81	12.04	10.19	3.70	3.70
	All the Time							Never
	8	7	6	5	4	3	2	1

Clearfield	My course looked the same as the people sitting around me.
Ridgway	More at the beginning of the course than at the end, especially more reviews. But toward the end I didn't need them. After awhile a "good" didn't suffice. More "excellents" are definitely needed.
Penn State	I loved when my name was inserted in a response--That motivated me. I didn't feel the communication was personal, yet I wasn't offended.
Smethport	Once in a while. The use of names and personal comments helped to personalize the course. Other than obvious review as shown in the frame numbers, I was not aware of individualization.

30. I was encouraged by the responses given to my answers to questions.

Location	Frequency in Percentages							
Clearfield (N=90)	3.33	3.33	4.44	12.22	7.78	18.89	18.89	31.11
Ridgway (N=118)	3.39	2.54	6.78	6.78	7.63	22.88	22.88	27.12
Penn State (N=27)	3.70	7.41	3.70	3.70	3.70	37.04	25.93	14.81
Smethport (N=108)	4.63	1.85	1.85	3.70	8.33	21.30	23.15	35.19
	Strongly Disagree							Strongly Agree
	1	2	3	4	5	6	7	8

Clearfield	They in some way substituted for the human teacher. The computer has a real sense of humor at the strangest times.
Ridgway	I wish it would have responded with my name more often. This made it have a very personal teacher to student effect. Answers to my responses enabled me to understand a concept a little more fully.
Penn State	At first I thought it was really neat, but after a while the responses became a little monotonous. At times the comments did not seem to help but rather just confused me more.
Smethport	Everyone likes praise, I agree with the question.

31. In view of the time allowed for learning, I felt too much material was presented.

Location	Frequency in Percentages							
Clearfield (N=90)	28.89	17.78	7.78	7.78	7.78	12.22	3.33	14.44
Ridgway (N=118)	42.37	19.49	12.71	7.63	5.08	6.78	.85	5.08
Penn State (N=27)	59.26	22.22	11.11	0.00	3.70	0.00	3.70	0.00
Smethport (N=108)	47.22	11.11	5.56	6.38	3.70	13.89	4.63	7.41
	Strongly Disagree							Strongly Agree
	8	7	6	5	4	3	2	1

Clearfield	A great deal of information was presented in the course of CAI. The major problem seemed to be in the scheduling of time. Not if the time had been more evenly distributed.
Ridgway	The material was not too heavy or difficult for the time. I felt that the course was overscheduled as to students. A better scheduling program should be devised.
Penn State	I am amazed that so much material could be presented effectively in a short time, but I do feel that the presentation was effective. I do not feel too much material was presented.
Smethport	I felt our time was cut short; therefore, we were cramming. The short period of time the van was going to be here made me buckle down and study more than I would have in a traditional situation.

32. I entered wrong answers in order to get more information from the machine.

Location	Frequency in Percentages							
Clearfield (N=90)	0.00	1.11	4.44	12.22	8.89	13.33	21.11	38.89
Ridgway (N=118)	0.00	3.39	4.24	5.93	8.47	16.95	22.03	38.98
Penn State (N=27)	7.41	0.00	3.70	0.00	0.00	22.22	41.81	51.85
Smethport (N=108)	0.00	3.70	6.48	8.33	8.33	12.96	19.44	40.74
	All the Time--Never							
	1	2	3	4	5	6	7	8

Clearfield	Sometimes I entered wrong answers just to see what would happen. Please tell us at the beginning of the course how we are graded. I wanted to enter wrong answers sometimes but wasn't sure if we should or not.
Ridgway	I didn't think that this could be done. I sometimes actually guessed and guessed correctly just to finish and move on.
Penn State	No comments.
Smethport	I did sometimes if I wasn't positively sure of an answer. Sometimes I felt the explanation following the wrong answers were very helpful, so I would try some of them.

33. I felt I could work at my own pace.

Location	Frequency in Percentages							
Clearfield (N=90)	8.89	2.22	5.56	5.56	6.67	10.00	15.56	45.56
Ridgway (N=118)	5.93	0.85	1.69	1.69	3.39	7.63	13.56	65.25
Penn State (N=27)	3.70	0.00	0.00	0.00	0.00	0.00	29.63	66.67
Smethport (N=108)	6.48	0.93	4.63	3.70	2.78	6.48	12.96	62.04
	Strongly Disagree							Strongly Agree
	1	2	3	4	5	6	7	8

Clearfield	There were plenty of times I felt I could have covered certain sections more rapidly. I would have strongly agreed if the scheduling had been easier.
Ridgway	I was not bogged down by slower students. The only thing that hindered this was the tight scheduling. Many times I wished I could push the information appearing on the CRT a bit faster.
Penn State	I started out coming to the lab very often at first during the beginning of the term with the idea that if I'd come often when the work load in my other courses was light I would be able to slacken off my pace at other times. I liked this aspect very much.
Smethport	I could work at my own speed even though I rushed at times personally. This is a big selling factor to people who teach and therefore have limited time.

34. Questions were asked which I felt were not related to the material presented.

Location	Frequency in Percentages							
Clearfield (N=90)	44.44	25.56	15.56	5.56	4.44	2.22	2.22	0.00
Ridgway (N=118)	38.14	31.35	17.80	5.93	5.08	0.85	0.00	0.85
Penn State (N=27)	62.96	22.22	7.41	0.00	0.00	7.41	0.00	0.00
Smethport (N=108)	54.63	23.15	12.96	4.63	2.78	0.93	0.00	0.93
	All the time							Never
	1	2	3	4	5	6	7	8

Clearfield	On some chapters. (only comment)
Ridgway	I felt the test contained questions which might of had several good answers and the material had not been covered well enough during the course.
Penn State	The questions were always related to the material. (only comment)
Smethport	No comments.

35. I was aware of the flickering screen while I was taking the course.

Location	Frequency in Percentages							
Clearfield (N=90)	8.89	3.33	5.56	8.89	8.89	11.11	21.11	32.22
Ridgway (N=118)	7.63	5.08	7.63	9.32	6.78	19.49	19.49	24.58
Penn State (N=27)	3.70	7.41	11.11	7.41	11.11	11.11	29.63	18.52
Smethport (N=108)	4.63	3.70	6.48	9.26	10.19	16.67	26.85	22.22
	All the Time 1	2	3	4	5	6	7	Never 8

Clearfield	Just like watching TV. Could not use eye glasses to advantage.
Ridgway	What flickering screen? Many times I found this quite distracting. I didn't find it a problem, but yes I was aware of the flickering screen.
Penn State	Only when I stayed too long and my eyes began to hurt. At first I was aware of this but after the first day this never caught my attention.
Smethport	Did not bother me. I became used to the flickering. Sometimes were worse than others.

36. Material which is otherwise boring can be interesting when presented by CAI.

Location	Frequency in Percentages							
Clearfield (N=90)	14.44	3.33	4.44	15.56	13.33	11.11	13.33	24.44
Ridgway (N=118)	5.08	2.54	1.69	14.41	5.93	20.34	20.34	29.66
Penn State (N=27)	7.41	0.00	11.11	0.00	11.11	33.33	33.33	3.70
Smethport (N=108)	3.70	0.00	3.70	9.26	7.41	20.37	17.59	37.96
	Strongly Disagree							Strongly Agree
	1	2	3	4	5	6	7	8

Clearfield	The fascination of the method helps. If material is not interesting I don't think even CAI can make it so.
Ridgway	I would not want to generalize that far. I felt very involved with the course. Sometimes in a classroom your mind wanders, here it couldn't.
Penn State	Due to the varied ways of presentation and the challenge it confronted me with.
Smethport	I really enjoyed the course because of the way it was presented. Only because you work at your own rate.

37. I could have learned more if I hadn't felt pushed.

Location	Frequency in Percentages							
Clearfield (N=90)	32.22	12.22	4.44	6.67	8.89	11.11	10.00	14.44
Ridgway (N=118)	46.61	13.56	4.24	5.93	4.24	10.17	7.63	7.63
Penn State (N=27)	51.85	22.22	11.11	7.41	3.70	0.00	0.00	3.70
Smethport (N=108)	32.41	18.52	7.41	5.56	5.56	9.26	7.41	13.89
	Strongly Disagree							Strongly Agree
	8	7	6	5	4	3	2	1

Clearfield	Again poor scheduling. I did not have time to read the complete reading assignments in the text by Smith because I am a full time teacher.
Ridgway	I never felt as if I was pushed. I worked at my own pace. I did not feel pushed until the question of being able to finish in the time limit arose.
Penn State	I never felt pushed. I created my own pressures.
Smethport	Who felt pushed? It was my own fault for not scheduling more time at the beginning of the course. I pushed myself because I was learning.

38. I was given answers but still did not understand the questions.

Location	Frequency in Percentages							
Clearfield (N=90)	4.44	5.56	4.44	7.78	10.00	24.44	23.33	20.00
Ridgway (N=118)	0.00	5.08	5.93	8.47	7.63	20.34	32.20	20.34
Penn State (N=27)	3.70	11.11	18.52	7.41	3.70	7.41	25.93	22.22
Smethport (N=108)	0.93	2.78	6.48	5.56	8.33	24.07	27.78	24.07
	All the Time							Never
	1	2	3	4	5	6	7	8

Clearfield	Again certainly on some chapters. Other chapters seemed to go overboard to explain things.
Ridgway	I didn't understand a few things and would feel better if I could take more time and ask someone a question but none was around to ask. Some questions were poorly phrased.
Penn State	Very rarely--I can't remember a specific example. Sometimes this was true.
Smethport	Some of the things I did not know enough about did not have enough of a preliminary explanation.

39. The course material was presented too slowly.

Location	Frequency in Percentages							
Clearfield (N=90)	3.33	7.78	8.89	10.00	10.00	18.89	15.56	25.56
Ridgway (N=118)	4.24	3.39	8.47	12.71	9.32	23.73	12.71	25.42
Penn State (N=27)	0.00	14.81	11.11	7.41	3.70	29.63	14.81	18.52
Smethport (N=108)	0.93	3.70	4.63	12.04	9.26	19.44	20.37	29.63
	All the Time							Never
	1	2	3	4	5	6	7	8

Clearfield	Occasionally a point was drilled too long. Quite a few of the earlier chapters were.
Ridgway	The audio seems slow at times. Not necessarily too slowly but in some areas that were particularly familiar to me I felt that too much of the same content was repeated. Perhaps others did not feel this way. The rate of presentation of material can be controlled by each student.
Penn State	Sometimes. Sometimes it seemed the machine was really laboring a concept that was very simple and it would get very boring.
Smethport	Only when the machine was working too slowly. Sometimes I felt the computer was giving me too much background material.

40. The responses to my answers seemed to take into account the difficulty of the question.

Location	Frequency in Percentages							
Clearfield (N=90)	5.56	5.56	8.89	15.56	10.00	15.56	24.44	14.44
Ridgway (N=118)	1.69	1.69	4.24	14.41	11.02	20.34	22.03	24.58
Penn State (N=27)	0.00	0.00	14.81	0.00	18.52	18.52	40.74	7.41
Smethport (N=108)	2.78	1.85	3.70	11.11	7.41	20.37	27.78	25.00
	Strongly Disagree							Strongly Agree
	1	2	3	4	5	6	7	8

Clearfield	Sometimes it was not clearly explained why some answers were right and others were wrong. Chapter 14 was very bad for me.
Ridgway	But I sure wish the course would take into account my poor spelling. To me one of the advantages of CAI seemed more noticeable on the case studies and the math parts.
Penn State	If I made an incorrect response, I was given more information with which to work and another opportunity to respond.
Smethport	Sometimes I did not read a question fully. Just the audio messages did at times.

41. While on computer-assisted instruction, I encountered mechanical malfunctions.

Location	Frequency in Percentages							
Clearfield (N=90)	8.89	14.44	20.00	15.56	15.56	16.67	7.78	1.11
Ridgway (N=118)	4.24	11.02	14.41	17.80	16.95	17.80	11.86	5.93
Penn State (N=27)	0.00	14.81	14.81	7.41	11.11	37.04	14.81	0.00
Smethport (N=108)	4.63	9.26	20.37	22.22	12.96	17.59	10.19	2.78
	All the Time							Never
	1	2	3	4	5	6	7	8

Clearfield	Yes as a matter of fact yesterday I came for the last time and sat down at three machines before one of them worked. Far too often.
Ridgway	I very seldom encountered malfunctions but there were occasions when material was not available for me to continue my work. Yes, sometimes. These malfunctions were always cleared and handled by the proctors. There are a few bugs to iron out although the machines were pretty efficient.
Penn State	There were a few malfunctions; however, I did not feel they were objectionable. Very rarely that couldn't be fixed right away.
Smethport	On a few occasions and so I would hesitate to say always. Mechanical malfunctions came about much less often than I had aniticpated.

42. Computer-assisted instruction did not make it possible for me to learn quickly.

Location	Frequency in Percentages							
Clearfield (N=90)	41.11	17.78	15.56	8.89	7.78	3.33	0.00	5.56
Ridgway (N=118)	49.15	18.64	12.71	5.08	4.24	1.69	4.24	4.24
Penn State (N=27)	37.04	18.52	22.22	3.70	3.70	7.41	0.00	7.41
Smethport (N=108)	55.56	23.15	8.33	5.56	1.85	0.00	3.70	1.85
	Strongly Disagree							Strongly Agree
	8	7	6	5	4	3	2	1

Clearfield	I learned much more in a shorter amount of time than I have experienced in very many other courses.
Ridgway	I think I was able to think a lot faster in many situations where otherwise I would have been unable to do so. I learned much but I feel that I have learned the major concept of being aware of the possible reasons for there being differences in my classroom and to try to help these students.
Penn State	There were many different means of learning this course. I think it made learning quickly more possible.
Smethport	Some of the math was difficult to learn from the machine.

APPENDIX K

Summary of SOS Scores at Three Locations: Clearfield, Ridgway, and Smethport, Pennsylvania

Robert A. Sedlak

Graduate Assistant

Summary of SOS Scores at Three Locations

There was reason to believe that the attitude of the students taking the CARE 1 course (as reflected by their SOS scores) would improve at each successive site because of the formative evaluation which generated changes in the course and in operating procedures.

A grouped frequency distribution of student's SOS scores from Clearfield, Ridgway, and Smethport, Pennsylvania appears in Table 4. A total of 21 students scored less than 189 (a neutral score) on SOS. A smaller percentage of students received low SOS scores at each successive location. The mean SOS score was also found to increase at successive locations.

In order to test the significance of this improvement trend, a 1 x 3 analysis of variance was performed on the SOS scores from the three locations. Results of the analysis of variance appear in Table 5. A highly significant F of 9.88 was obtained, and the null hypothesis was rejected. In light of the fact that the homogeneity of variance assumption had been violated, the Behrens-Fisher t' statistic was computed on pairs of SOS scores to determine which pairs of SOS scores accounted for the difference. Results of the Behrens-Fisher t' test are reported in Tables 6, 7, and 8.

The Clearfield-Ridgway comparison and the Clearfield-Smethport comparison were both significant beyond the .01 level of confidence. The Ridgway-Smethport comparison was not significant. There was, however, a trend to indicate improvement at the Smethport location.

It can probably be concluded then that the formative evaluation of CARE 1 was successful in bringing about improvements in the course as indicated by the increase in mean SOS scores, lower variability between scores at each location, and a smaller percentage of scores lower than 189 at each successive location.

It may further be concluded that the decrease in variability of SOS scores and the lower percentage of scores below 189 at each successive location may indicate that the changes made took into consideration the dislikes of individuals at the lower end of the SOS scale and made the course and CAI much more acceptable even to individuals who were extremely critical.

Table 4

Grouped Distribution of the Student Opinion Survey Scores for Students who took CARE 1 at Clearfield, Ridgway, and Smethport, Pennsylvania

Score	Frequency
300 +	3
286 - 299	33
272 - 285	41
285 - 271	55
244 - 257	49
230 - 243	45
216 - 229	36
202 - 215	23
188 - 201	11
174 - 187	10
160 - 173	2
146 - 159	1
132 - 145	6
118 - 131	0
104 - 117	1
90 - 103	1
	N = 317

Table 5

Analysis of Variance of Total SOS Scores from Clearfield, Ridgway, and Smethport

Source	df	ms	f
Between	2	11791	9.882*
Within	314	1193	

*p < .01

Table 6

Means, Standard Deviations, and Behrens-Fisher t' Statistic for SOS Scores for Ridgway and Smethport

Location	n	mean	s.d.	t'
Ridgway	125	247.38	33.76	1.656
Smethport	115	254.07	28.77	

Table 7

Means, Standard Deviations, and Behrens-Fisher t'
Statistic for SOS Scores from Clearfield and Ridgway

Location	n	mean	s.d.	t'
Clearfield	77	231.65	42.76	2.75*
Ridgway	125	247.38	33.76	

*p < .01

Table 8

Means, Standard Deviations, and Behrens-Fisher t'
Statistic for SOS Scores for Clearfield and Smethport

Location	n	mean	s.d.	t'
Clearfield	77	231.65	42.76	4.03*
Smethport	115	254.97	28.77	

*p < .01

APPENDIX L

Analysis of SOS Scores and Comments at Four Locations: Clearfield, Ridgway, and Smethport, Pennsylvania and The Pennsylvania State University

Robert A. Sedlak

Graduate Assistant

Clearfield

The coefficient alpha reliability of the SOS administered at this location was .90. The means and standard deviations are reported in Table 7. Eleven students had SOS scores of less than 189, which is the theoretical neutral score.

An examination of the comments of these 11 individuals and their ratings for each statement in SOS reveals that primarily their expressed low opinions related to mechanical problems as opposed to course oriented problems.

The Clearfield operation was plagued at the beginning by power connected machine failures which in turn produced scheduling problems and cancelled "on-line" appointments.

Originally the CAI system was to be installed in a mobile van for the Clearfield location. However, due to production difficulties, the van was not ready, and so the system was installed in a room at the Clearfield High School. The former vocational shop was not designed for classroom use. Poor acoustics also contributed to the instruction problems. The negative comments below reflect both the mechanical problems and the distracting physical surroundings.

> I was signed off more than I was signed on.
>
> I dislike CAI most because of the malfunctioning of the equipment which made it rather difficult to concentrate on the content of the material attentively.
>
> The mechanical failures were very frustrating.
>
> Lighting was quite bothersome.
>
> More quiet will be necessary to concentrate and not so much pressure to get done with the course.
>
> Scheduling time was a problem and mechanical failure frustrating, but the course was wonderful.
>
> The system has to be made more stable . . . I could have proceeded faster if there were less interruptions.

In spite of these problems, the overall attitude appeared to be favorable as exemplified by the mean SOS scores (Table 7) and the students' comments. The following comments, taken from SOS indicate those things they liked best about the CARE 1 course.

> I liked CAI because,
> 1. CAI was located where I work,
> 2. I could choose working time on the CAI at my convenience,
> 3. Many fellow teachers were involved and much interest in the course resulted.
>
> I really enjoyed CAI very much. The material is presented in a fresh and interesting way. I feel as though I have had a private tutor. I am amazed at the complexity of problems facing our children and feel as though I have gained a better understanding of how to help them.
>
> I like the flexible scheduling time.
>
> I like CAI instruction because I learned more than I probably would have using traditional teaching methods. You have to learn the course material presented. The station would not proceed until it was sure that you had adequately learned the material presented. Unlike in a classroom situation where you can tune out your teacher or professor, you could not tune out or shut out your station, you just had to learn.
>
> The equipment was extremely patient when I had trouble with the material.
>
> I did enjoy the material of the CAI course of EEC 400. In most cases I really did get some new insights into the problems of educating students with deviations. I believe the course was beneficial to me and it is already a factor in improving some of the methods of teaching and also testing procedures that I am using in the classroom situation. I am considering the differences that need to be noted to help the student improve in the school learning situation.

Ridgway

The coefficient alpha reliability of the SOS administered at Ridgway was .86. The mean and standard deviation are reported in Table 7. A comparison of the mean score at Ridgway with the mean score obtained at the previous location (Clearfield) revealed a 15 point mean increase. There also were fewer people (only 7) whose expressed SOS score was less than 189 as compared to the students who took the course in Clearfield.

The modifications made in the course, fewer mechanical problems, and changes in operating procedures generated by the formative evaluation appear to have contributed to the higher mean SOS score at Ridgway.

While many improvements were made in the course between the time the course was offered at Clearfield and Ridgway, students still commented on specific problems. Primarily these dealt with scheduling and the low temperature of the van. There were also some comments dealing with the computer not accepting the student's response and about distracting noises from the proctors and other students.

The comments below reflect the opinions of the students who took the course in Ridgway.

> I did not feel pushed in the course.
>
> At times I became discouraged because the computer insisted that my answer was wrong because I had used slightly different terminology.
>
> Some consideration should be given to a new cooling system so that one is not distracted by the cold air.
>
> I felt the course was good except for scheduling.
>
> I liked the course. Although we sometimes encountered mechanical problems, and although the room was sometimes freezing, the advantages far outweighed this.
>
> I liked the availability and the ability to work at your own pace best. I feel it covered the course as well as possible, perhaps a little more testing per each chapter would help.
>
> The time for the course could be more organized and the temperature of the room more constant.
>
> I enjoyed the course very much. At first it scared me but as time went on I found it exciting and intend to use it in my classroom.
>
> I liked it because I was given much learning in a short time without having to travel a long distance.
>
> The most frustrating part of the course was the difficulty scheduling. This was no doubt due to the number of students enrolled and could certainly be more efficiently planned. Course content was not only interesting but well presented.
>
> I enjoyed this course very much. I liked working at my own pace and also I liked not having the pressure of a classroom situation. I would very much like to take other courses such as this. At times I would have liked it to be a little more flexible, but I feel this is a good way to learn material. I know for myself that I am more likely to retain material that I have read and then been reinforced with material by short quizzes and review.

> I like computer instruction for the following reasons: No personality conflicts, positive reinforcement, organized planning, elimination of stressful situations. I did not like it because of tediousness . . . The small L could not be used as a 1.

The Pennsylvania State University

The 27 students who took the CARE 1 course at Penn State during the winter term, 1971, were randomly selected from a group that had registered for EEC 400, an introduction to exceptional children course taught at Penn State. During the winter term the EEC 400 course covered the same material and concepts as the CARE 1 course offered by CAI. A study was to be conducted comparing the CAI group with the conventionally instructed groups on the effectiveness of CAI as "teacher." When registering for the EEC 400 course none of the students realized that some of them would be selected to take the course by CAI.

The students' comments below reflect their attitude toward taking the EEC 400 course by CAI.

> I enjoyed being called by my first name.
>
> I feel as though I finished the course in about as much time with the computer as I would spend in class (possibly a little more) but I took as much time on the material as I felt was necessary to develop an understanding.
>
> Sometimes I would have liked to argue with the computer or felt that the question was not worded clearly.
>
> How do you argue with a computer?
>
> After two years of PSU's mass education it was a joy to get some individual attention.
>
> I found the situation I was forced into very frightening. As far as I'm concerned the way I was dragged into this method of instruction was not good. I started this instruction with a negative attitude because I was forced into the situation unwillingly. This method of instruction had to be doubly interesting for me to compensate for the start with a negatively biased opinion.
>
> I liked coming here on my own time and not having to go to class. I also think I learned a lot and covered a lot of material in a short amount of time. I did not like the audio messages.

> I liked the course because it was so different and because I wasn't competing but I feel as though I missed something by not being able to take part in classroom discussions and by not receiving any information that a professor can give from his own experiences.
>
> I enjoyed working with a computer for the simple fact that I could work at my own speed. However, at times I could not get the computer to understand the fact that I simply could not answer some of its questions.
>
> Overall, it was a fascinating experience, however, at times the computer went too slowly, and there was no way to speed it up if you already understood the concept that it was trying to drum into your head.

A comparison of the Penn State students and the students from Clearfield or Ridgway could not be validly made because the Penn State students represented an entirely different population than those in the other two locations. For this reason only a summary of the Penn State students' SOS scores were made.

The coefficient alpha reliability of the SOS administered at Penn State was .86. The mean total score was 245.7 with a standard deviation of 40.47. The grouped frequency distribution in Table 9 indicates that only two students had SOS scores of less than the theoretically neutral score of 189.

The comments recorded by the entire group were for the most part quite favorable. Some students indicated that they would have preferred to take the course with an instructor as opposed to a computer but the vast majority felt the CAI was more efficient and enjoyable. They especially liked the flexibility of scheduling and working at their own speed.

A comparison of the results of the CAI group and the conventional instruction group on performance are reported elsewhere in the report.

Smethport

The coefficient alpha reliability of the SOS administered at Smethport was .82. The mean score and standard deviation are reported in Table 8. Only 3 persons rated SOS scores lower than the theoretical neutral score of 189 at this location.

Table 9

Group Distributions of Student Opinion
Survey Scores for Students who took CARE 1 at
The Pennsylvania State University

Score	Frequency
300 +	1
286 - 299	2
272 - 285	3
258 - 271	5
244 - 257	5
230 - 243	7
216 - 229	2
202 - 215	0
188 - 201	0
174 - 187	1
160 - 173	1
146 - 159	0
132 - 145	0
118 - 131	0
104 - 117	0
90 - 103	0
	n = 27

The formative evaluation of CARE 1 was still being conducted at the Smethport location. Student opinions of the course continued to improve. This may be inferred, in contrast to previous locations, from the higher mean SOS scores, smaller standard deviation of SOS scores, and the smaller percentage of persons with SOS ratings less than 189.

Fewer negative comments on specific problems were also noted. Those that were received at the present location covered a number of topics and may be accounted for by individual tastes. A number of students commented on the cold air conditioning system, and a few students commented on answers that the computer would not accept. Scheduling was much less a problem at this location than in preceding ones. On the whole, reception of the course at Smethport was the most favorable of any of the locations. An overwhelming majority of the comments were positive. Listed on the following page are some of those comments.

> I liked the presentation, the convenience of scheduling my own time, the supplementary materials. My only real complaint is the weather inside the van. Perhaps this is unavoidable. Good job, Penn State.
>
> I liked the freedom of scheduling my own time and not having a strict schedule.
>
> It was real interesting and I liked the pace.
>
> The course was informative and saved time.
>
> The only complaint I have is that the computer van is just too darn cold.
>
> The course seems relevant to the teachers who will use the material presented every day . . . Can't wait for a follow-up course in remedial techniques.
>
> I liked it because it enabled me to take an active part. I find regular classroom instruction very boring.
>
> I thought it was great I wish I could get courses in the math field.
>
> The only problem I encountered was that of extra-curricular noise, i.e., from the air conditioner and especially from the proctors and other students. Every other aspect was really above my expectations for a course of this nature.
>
> In general it is a practical method of instruction--scheduling of course time, in regard to personal likings, seemed good to me.
>
> The availability of audio, visual, and typing equipment makes the course more interesting.
>
> I think at times the material was presented too slowly--however, for the most part I enjoyed the course very much and would like to take another of its type at a future date.
>
> I enjoyed the course and found in a few instances that my answers turned out right and were marked wrong. This is my only complaint.

The total SOS score and the small percentage of persons with SOS scores of less than 189 are an indication that the formative evaluation being conducted is helping to bring about constructive changes in the course and in the operating procedures.